FEBRUARY, 1925 25 CENTS

Wireless Age

The Radio Magazine

Magic Notes from Golden Throats

Both the magic and the golden tone quality are retained if your receiving set is equipped with Cunningham Tubes. To detect accurately, to amplify clearly, to give the utmost in radio reception—that is their job. Cunningham Tubes serve long and well. They combine the rarest scientific accuracy with rugged durability.

Since 1915 standard
for all sets.

Types C-301A, C-299, C-300, C-11 and C-12—*In the Orange and Blue Carton.*

Cunningham RADIO TUBES

Home Office:
182 Second Street,
SAN FRANCISCO

E. T. Cunningham Inc.

CHICAGO
NEW YORK

PATENT NOTICE: Cunningham tubes are covered by patents dated 2-18-08, 2-18-12, 12-30-13, 10-23-17, 10-23-17, and others issued and pending.

TOWER'S

APPROVED THE WORLD OVER!

Approved by magazines and newspapers the world over, including Radio News, Radio Broadcast, Popular Radio, Radio, New York Sun-Globe, and everywhere else wherever subjected to tests.

— and recognized as the
World's Greatest Headset Value

TOWER'S Scientific

Perfect Tone Mates

NOW $2.95

Plus a few Cents Postage

Only because we are the LARGEST EXCLUSIVE MANUFACTURERS of Headsets in the country are we able to produce the TOWER'S SCIENTIFIC at the low price of $2.95.

Every Set of Tower's Scientifics are tested and approved by licensed radio operators.

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Longer cord (full 5 feet). Every set covered with our money-back guarantee.

Production over one million double headsets for this season. Fourteen days' production, if placed in cartons, one on top of the other, would reach a mile into the sky.

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THE TOWER MFG. CORP.
98-Q Brookline Ave., Boston, Mass.

Scientific

"Quality Goods for Quality Readers"

Wireless Age

The Radio Magazine

Vol. XII *No. 5*

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Your Authors

DR. R. L. POWER (Around and About the Golden Gate) is well qualified to tell us about the principal feature programs that are broadcast regularly from the several broadcast stations bordering the Pacific Coast. He is actively engaged at station KFI in arranging programs to suit the popular taste in which he has been highly successful.

MISS ANNE C. GRANBECK (Radio-Paris) is an experienced journalist, having written for quite a few weeklies and dailies including the "New York World", "Travel Magazine" and "Hardware Age". She has operated a Tourist's Advice Agency and has an extensive knowledge of matters pertaining to travel both here and abroad. During the War she served with the American Expeditionary Forces and rendered valuable service.

DR. J. P. MINTON (Loud Speakers and Radio Reception) graduated as an Electrical Engineer at the Bradley Polytechnic Institute. He also graduated in Mathematical Physics at the Massachusetts Institute of Technology with the degree of B. Sc. As post graduate student in Physics and Mathematics, University of Chicago, Dr. Minton was awarded the degree of Doctor of Philosophy, the highest honors given by the University. Working three years in the General Electric Co. Research Laboratories he developed the cathode ray tube to a high state of perfection, and invented the cathode ray tube watt-meter and oscillograph.

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Because certain statements and expressions of opinion from correspondents and others, appearing in these columns from time to time may be found to be the subject of controversy in scientific circles and in the courts either now or in the future and to sometimes involve questions of priority of invention and the comparative merits of apparatus employed in wireless signaling, the owners and publishers of this magazine positively and emphatically disclaim any privity or responsibility for any statements of opinion or partisan expression if such should at any time appear herein.

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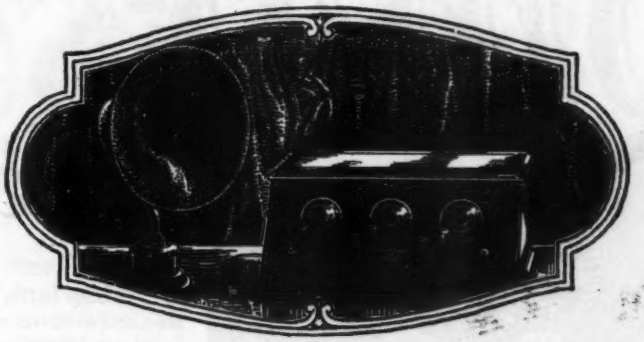

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THE Thompson Organization is unique among radio manufacturers in having a background of 15 years experience in designing, developing and manufacturing intricate and delicate radio apparatus for the armies, navies and commercial institutions of the world.

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This wide experience, now available in the Thompson apparatus, means Receivers and Speakers that embody the latest and best practice in Radio Engineering. A critical investigation of each model will disclose outstanding features of genuine excellence — in artistic appearance, naturalness of tone, simplicity of operation.

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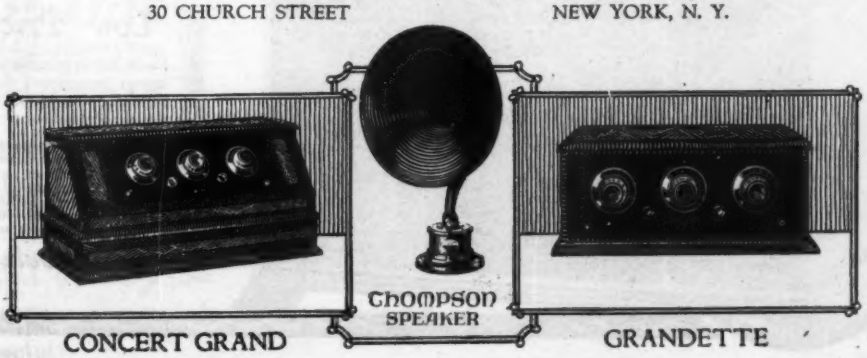

Somerset Quality

EVERY once in a while somebody brings forth an idea so big, so valuable, and so obvious, that everybody recognizes its merit immediately and wonders why it wasn't done long before. That is the reception which the public has accorded the Somerset Radio Receiver — the perfect tuned radio frequency line. Almost over night it has leaped into leadership through its unmistakable superiority in design, quality and value. The Somerset line consists of four models — Stratford Model 4-A, 4 tube set, 2 dials — $65. Mars Model 5-A, 5 tube set, 3 dials — $75. Shelbourne, Model 4-B, 4 tube set, 1 dial, synchronized control—$85. Standish, Model 4-C, 4 tube set, 1 dial, synchronized control, with built-in loud speaker—$150.

STRATFORD MODEL 4-A

4 Tubes—Dual Control

A superior four tube, tuned radio frequency receiver—two dial control—operates on storage battery or dry cells. Automatic filament control insures long life of tube s The finest "low loss" condensers and the famous SOMERSET Calibrated Transformers are features. "B" battery space is provided in the handsome two-tone mahogany finish cabinet. Size 21" x 15" x 11". **List $65**

WHEN you buy a Somerset Radio Receiver our obligation just begins. For we sell not merely radio receivers but radio *reception*. You must be satisfied, and you should not be satisfied with anything less than the best reception possible in your location. Somerset Service is organized to see that you get it. Every Somerset dealer is trained in Somerset Service and is anxious that you shall get the best possible results. He will take a real interest in seeing that you do get them. That is why he is a Somerset dealer. But if, by any chance, he should disappoint you, we pledge the entire resources of the Somerset organization to your complete satisfaction.

Prices subject to change without notice

SHELBOURNE MODEL 4-B

4 Tubes—Single Dial Control

Our perfected tuned radio frequency circuit with single dial synchronized control. Storage battery or dry cell operation, automatic filament control, the finest "low loss" condensers, and the famous SOMERSET Calibrated Transformers. Compartments for large sized storage "A" and dry cell "B" batteries. Mahogany finished cabinet hand-rubbed two-tone effect. Size 27" x 15" x 12". **List $85**

EVERY STATION IS E-A-S-Y with the single dial synchronized control—featured on our Shelbourne and Standish Models. A simple twist of the big comfortable dial and your favorite station comes in—always at the same point. No need to fuss and adjust—you turn to it as confidently as you turn into your own street going home. The Somerset single dial synchronized control has been perfected after most exhaustive tests, and is made possible only by the most painstaking selection and matching of coils, condensers and transformers. Leading radio engineers have pronounced it a triumph of radio engineering.

Low Prices!

Each Somerset Radio Receiver represents the best that can be produced for the money—the utmost in results and permanent satisfaction to the owner. Compare them feature for feature with any others at or near their price range—bar none. Fill out and mail the coupon for full information about these splendid instruments. Don't put it off—send today.

Real Values!

Somerset Radio Receivers

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Radio at a Price!

SOMERSET cabinets are unique — each a piece of fine furniture to grace milady's drawing room. Substantial construction, with artistic two-toned, hand-rubbed mahogany finish. Somerset technical features are equally remarkable—secured not only by superior wiring and workmanship but by painstaking care and test in selecting parts and materials. Somerset Radio Receivers are easily the greatest value in radio to-day. And Somerset technical features—too many to describe in detail here—are equally notable. In simplicity of operation, reliability, range, selectivity and tone, Somerset Radio Receivers are without peers in their price range—easily the greatest values in radio to-day!

The Famous Somerset Guarantee — Satisfaction—or Money Back

YOU must be satisfied with this receiver or we do not want you to keep it. If for any reason you feel that it is not exactly as represented or that it is not the quality and value which you have a right to expect, we want you to return it for exchange or for refund, whichever you prefer. We will cheerfully and promptly make good any Somerset product which does not fully measure up to your expectations.

EVERY completed Somerset Radio Receiver must pass the rigid tests of the Somerset Engineering Laboratories before it is certified "O.K. for shipment". It must function perfectly or it cannot leave the Somerset laboratory. And that is why Somerset Receivers are so remarkably sensitive and selective, reaching out to get broadcast programs from incredible distances, and reproducing them with precise fidelity and rich mellow tone. It is this infinite care with the "tremendous trifles" that places Somerset Radio Receivers in a class by themselves.

5 Tubes—Three Dial Control

Two stages tuned radio frequency, detector, and two stages audio frequency. Storage battery or dry cell operation, automatic filament control, highest quality "low loss" condensers and the famous SOMERSET Calibrated Transformers. Artistic cabinet hand-rubbed mahogany finish providing space for dry cell "B" batteries. Size 29" x 14" x 12" . . . . List $75

Prices subject to change without notice

4 Tubes—Single Dial Control with built-in loud speaker

STANDISH MODEL 4-C

Combining a built-in loud speaker of the highest type and the four tube tuned radio frequency circuit with single dial synchronized control—all the latest and best in radio. Storage battery or dry cell operation, automatic filament control, highest quality "low loss" condensers, and the famous SOMERSET Calibrated Transformers. Ample space is reserved in this cabinet for standard size high ampere hour storage "A" batteries and dry "B" batteries. Exquisite cabinet, antique mahogany finish. Size 29"x13"x14". List $150

Fill Out

National Airphone Corp.
16 Hudson St., N. Y. City

Without any obligation to me send full details and information on the Somerset line

Name.....

City.....

State.....

Mail Today

MFD. by NATIONAL AIRPHONE CORP. 16-22 Hudson St. New York City

Prices west of the Mississippi, add 10%.

LET the others have their card games—Grandpa settles down to real amusement—at the radio.

His dependable Brandes Headset shuts out the babble. Its *Matched Tone* gives him each word clearly—with identical tone and equal volume for both ears.

Grandpa's in a world of his own—and the game continues undisturbed. Everybody's happy!

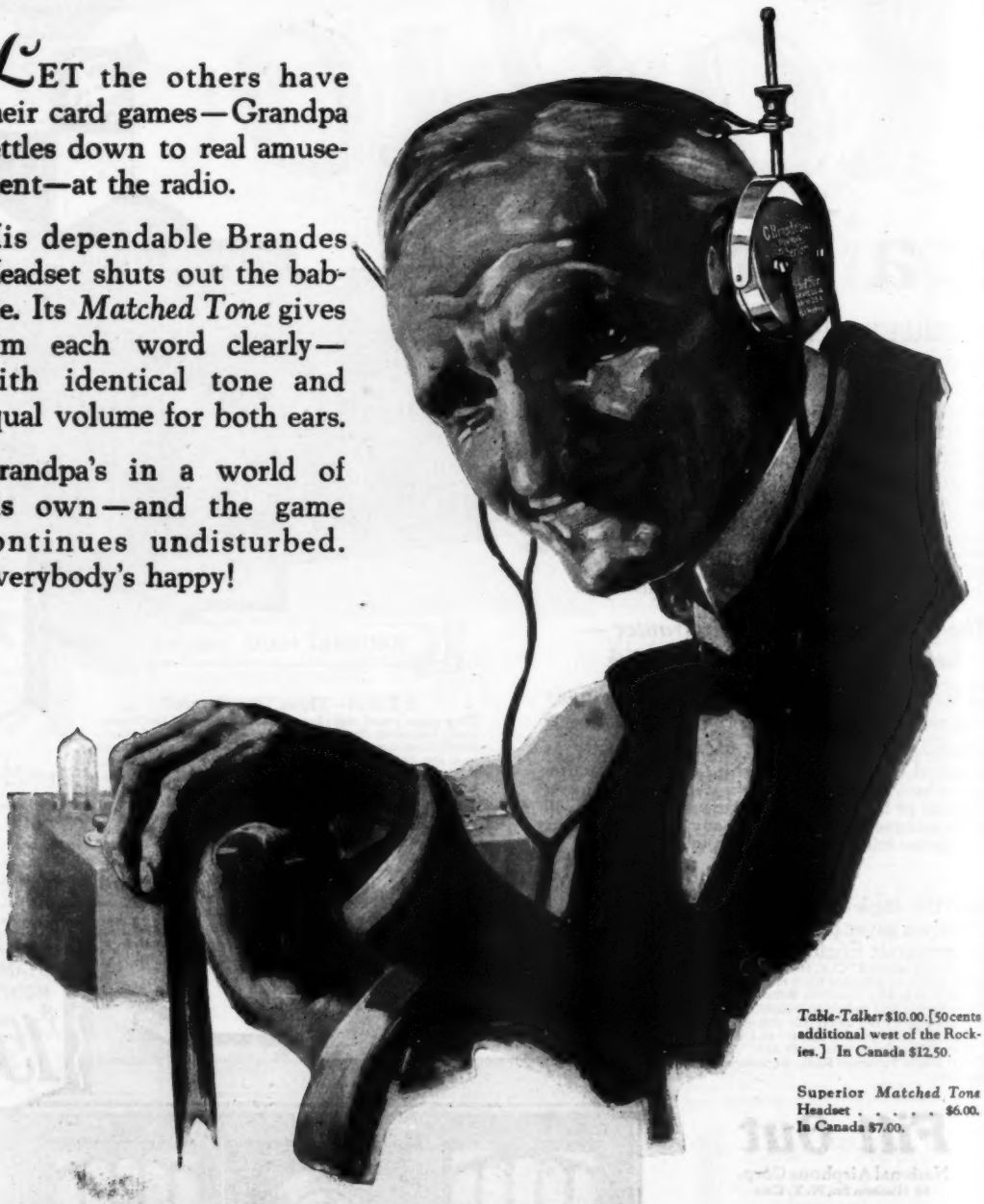

Table-Talker $10.00. [50 cents additional west of the Rockies.] In Canada $12.50.

Superior *Matched Tone* Headset . . . . . $6.00. In Canada $7.00.

Brandes

The name to know in Radio

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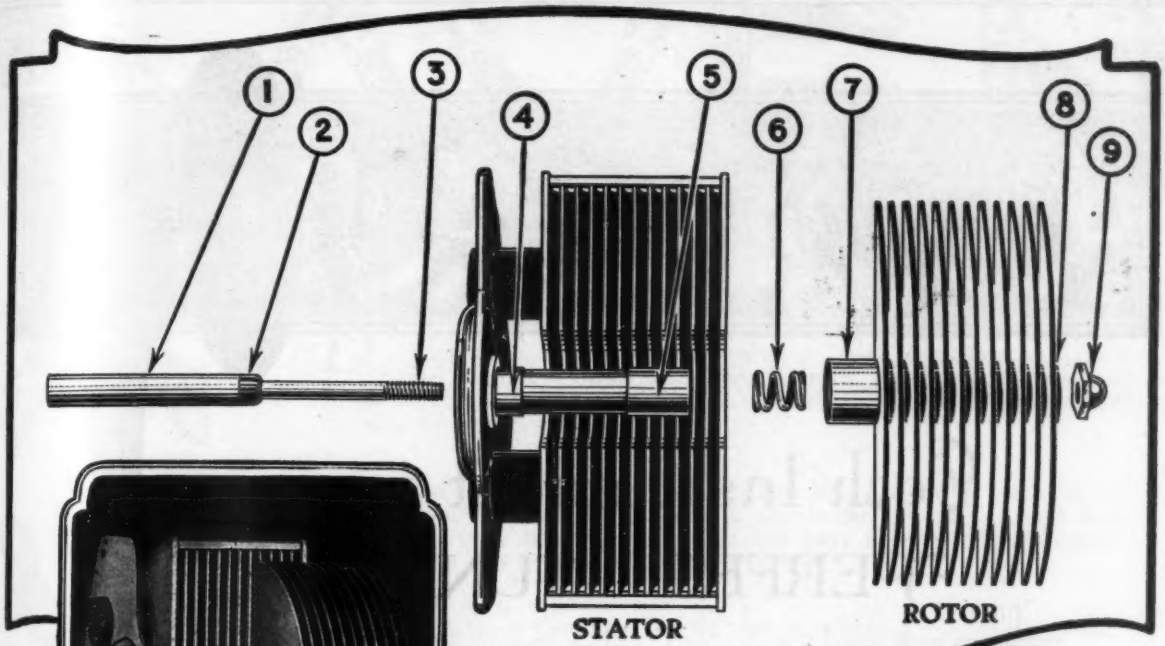
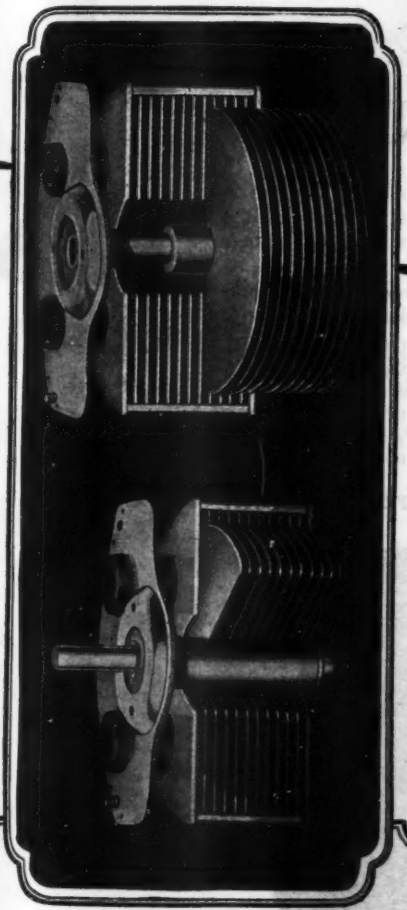
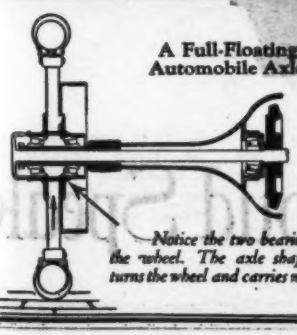
"Quality Goods for Quality Readers"







A Full-Floating Automobile Axle

Notice the two bearings for the wheel. The axle shaft only turns the wheel and carries no load.

The Condenser with the "*full floating axle*"

The striking feature of the Bradleydenser is the rigid double bearing, based on the principle of the "full-floating" automobile axle, that eliminates the usual outer pivot-bearing for the rotor shaft, and still provides a non-sagging support that insures perfect alignment of the rotor plates.

The rotor plates, soldered on a long, hollow tube extending from [7] to [8], revolve on a hollow steel stem provided with *two* bearings [4] and [5]. The alignment and support of the rotor is independent of the condenser shaft [1], as shown by the first photograph at the left. The shaft [1] merely turns the rotor. It slips through the hollow steel stem and its threaded end [3] is secured to the rotor at [8] with the nut [9] as shown in the second photograph. The spring [6] prevents end-play.

This design, combined with the use of soldered brass plates, results in a rugged, long-life condenser of extremely high efficiency. For superior service use the Bradleydenser.

Allen-Bradley Co.
Electric Controlling Apparatus

General Office and Factory: 283 Greenfield Ave., Milwaukee, Wisconsin

Bradleydenser
PERFECT VARIABLE CONDENSER

Each Instrument in PERFECT TUNE

HERE is the test of a loud speaker. Tune in a great orchestra. Do you hear a grand ensemble in perfect harmony? Or,—do the upper tones of the violins, the flutes, the oboes and the clarinets come in a trifle "flat"?

Music—not mere noise—is what you should demand in a loud speaker these days. And music is not music unless it is harmony.

The Bristol Audiophone brings in voice or instrument in perfect tune just as it sounds in the studio. This is because it is itself a true musical instrument; not merely a phone unit in a horn. You will love your Audiophone as you would love a fine violin.

There are five Bristol Audiophones, priced from $12.50 to $30.00. If not at your dealer's, write for Bulletins Nos. 3011, 3017 and 3022-V.

THE BRISTOL COMPANY, Waterbury, Conn.

Model S Audiophone $25.00

Rubber horn 14½" in diameter. Cast metal throat. Velvet mat finish of mottled bronze and gold.

Cabinet Model $30.00

Beautifully finished mahogany. Full floating wooden horn and cast metal throat. Musically, a companion to the finest set ever built; size 17x10x10¼".

BRISTOL AUDIOPHONE Loud Speaker

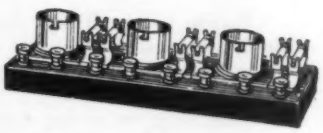
DAVEN

DAVEN is the real word for dependability when connected with Resistance Coupled Amplification. Daven engineers designed and built the first Resistance Coupled Amplifier offered the Broadcast fan—they were the pioneers and their devices have blazed the way for others to follow.

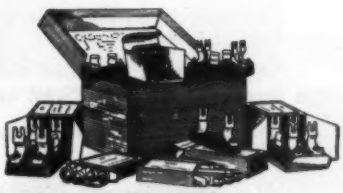
The Daven Resistance Coupled Amplifier Kits are highly perfected—their assembly is very simple—their output perfect. By adding this amplifier to your favorite tuner, you will have a worthy combination, hard to beat, and amplification that is perfect.

With Resistance Coupling the volume is adequate for all purposes, while the tone quality is overwhelmingly superior to any other form of amplification. The name Daven is the "Sine of Merit" and your safeguard when you go out to buy.

The Daven Super Amplifier Unit is laboratory tested and comes ready to install. The base is of molded Bakelite and small enough to fit within any cabinet. All wiring is hidden beneath the base.



The Daven Kits are supplied for either three or four stages—sockets and mica fixed condensers are not included, but instructions are furnished giving complete information and diagrams.



You can buy the Daven Products at any good Radio Store.

TRADE MARK

DAVEN RADIO CORPORATION

"The Sine of Merit"

Resistor Specialists

Newark, New Jersey

Ask your Dealer for a copy of our 25c handbook—"RESISTOR MANUAL" telling about the many possibilities of Resistance Coupled Amplification and how to use it with any of the standard forms of receivers.

SWEEP THE AIR With Air-Way

The Leader of the five-tube, tuned radio-frequency receivers, in which is embodied all of the latest developments in low-loss construction, clarity of tone, simplicity in tuning, and mechanical excellence.

Range to reach any point in North America, and European stations under reasonably favorable conditions.

Selectivity to cut through the worst of local interference.

The only receiving set of this type now on the market equipped to operate with either loop or antenna, with switch for making instant change.

Tone unexcelled in musical quality.

Volume to operate an efficient loud speaker on any station with sending power capable of reaching the set.

Appearance, dignified design; material of cabinet, five-ply black walnut; and finish to match the surroundings of the best appointed homes.

A set that meets the requirements of the most discriminating buyer, yet sold at a price to meet popular demand.

We invite investigation on the part of live and reponsible dealers who are able to appreciate the value to them of a radio set that sells easily and stays sold, with profit to them and satisfaction to the customer.

Air-way Model 51, Five point, Five tube receiver. Price in cabinet as illustrated, $125.00.

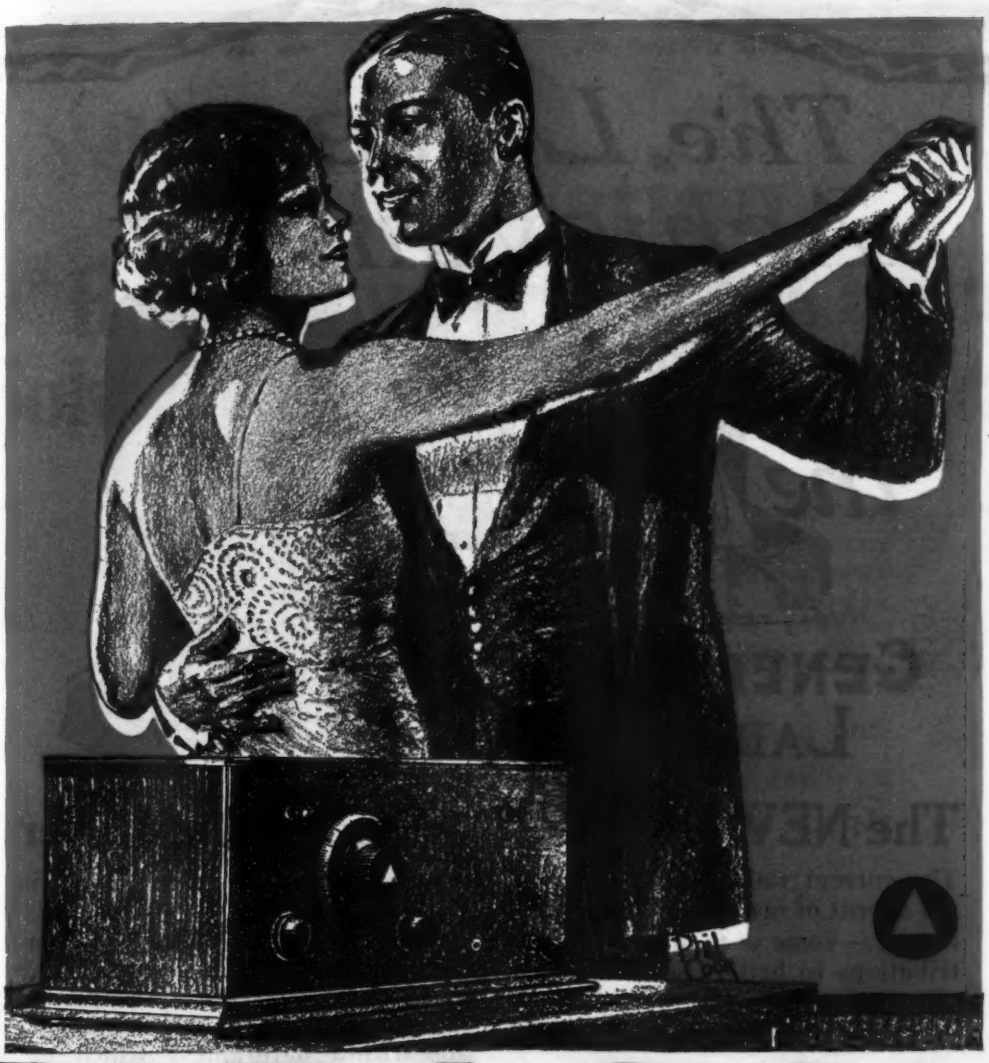
Model 52, practically the same in detail as Model 51, but built into the handsomest console cabinet in the market; in which is ample room for all batteries and equipment, and a built-in loud speaker with Thorola unit, making a set complete in itself. **Price, $375.00.**

Our Model 41 is a four-tube, tuned radio frequency receiving set unexcelled in quality and efficiency, and we believe beyond question the most satisfactory four-tube set on the market. **Price, $65.00.**

Live dealers write for further details, and our Special introductory proposition

AIR-WAY ELECTRIC APPLIANCE CORPORATION

TOLEDO OHIO



THE NEW

PARAGON

REG. U. S. PAT. OFF.

FOUR $65

Gets Everything

PLUG the loudspeaker in—press the switch button—turn the one tuning dial—and the whole country's broadcasting is at your command. Strong, clear, natural, the far-distant stations separate themselves from nearby ones. The announcers' voices ring out undistorted, and the broadcasting, whether music or speech, satisfies you as you've never expected to be satisfied.

This new four-tube set is the latest Paragon triumph—Paragon, whose distinguished past records entitle it to a premier place in the radio world. And whose manufacturing experience enables the production now of this real Paragon set at such a surprisingly low price.

WRITE FOR "STATION PLEASE"

Interesting free booklet describing the Paragon Four and other Paragon Receivers.

NEW PARAGON FOUR $65.00

Four tubes. Single dial control. Range almost unlimited for clear loudspeaker reception. New Paradyne non-radiating circuit. Mahogany case, 21 inches long.

NEW PARAGON THREE $48.50

Three tubes. Single dial control. Loudspeaker volume over surprising range. Mahogany case, 17 inches long.

NEW PARAGON TWO $27.50

Two tubes. Single dial control. Loudspeaker volume over moderate range. Mahogany case, 11 inches long.

ADAMS MORGAN CO., Inc. 8 Alvin Ave., Upper Montclair, N. J.

Makers since 1915 of Record-holding Radio Receivers

"Quality Goods for Quality Readers"

The Latest Achievement of the

GENERAL RADIO LABORATORY

The NEW Type 285 Audio Transformer

The current radio season has seen the advent of many new audio transformers—some of them worthy contributions to better amplification.

Now comes the announcement of the new General Radio transformer which sets an even higher standard of amplification. One stage of amplification using a type 285 transformer operates a loudspeaker with good volume and a quality of tone that is unequalled.

It amplifies high and low notes evenly over the whole audio range so that instrumental or vocal tones are reproduced individually or in combination with a naturalness which delights the most critical radio listener.

If you want the best there is in transformer design, the type 285 should be your choice.

Price $7.00

See one at your Dealer's

GENERAL RADIO Co
Cambridge Mass.

GENERAL RADIO Co
GR
Cambridge, Mass.
U.S.A.

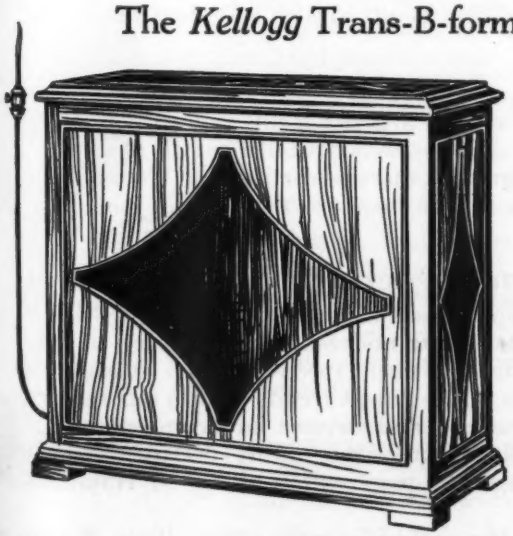
Write for Descriptive Bulletin 920-W

The Question of B Battery Current Has Been Solved with the *Trans "B" former*

The *Kellogg* Trans-B-former furnishes the necessary plate voltages for your radio set, from your 110AC, 60 cycle, electric light socket without any interferences.

This unvarying current is furnished at less than one-fifth cent per hour. Throw away your "B" batteries and install a Trans-B-former and your set will operate at maximum efficiency constantly.

The *Kellogg* Trans-B-former will:



Improve reception.

Reduce operating cost to a minimum.

Add to the appearance of your set.

Increase DX possibilities.

Developed, perfected and guaranteed by the Kellogg Switchboard and Supply Company.

At Your Dealers

Each.....*$50.00*

KELLOGG SWITCHBOARD & SUPPLY CO.

1066 WEST ADAMS STREET, CHICAGO

"Quality Goods for Quality Readers"

Editorial Chat

THAT the radio art advanced during last year is evidenced by short wave transmission, Marconi's beam system or directional transmission and the Radio Corporation of America's development of the Photoradiogram, the story of which appears in this issue, written by one of the engineers who helped in the development of the system. "The Photoradiogram" opens up a vista of potential uses in modern life that only yesterday were considered dreams. In the same vein—with the latest information on the subject—you will undoubtedly enjoy reading "Loud Speakers and Radio Reception." It will appeal to radio fans particularly—since it concerns each and all what quality of sound waves radio receivers generate.

Radio-Paris

Miss Anne C. Granbeck, a well versed travel writer, in this issue of WIRELESS AGE conducts us to France to view radio broadcasting conditions there. Capt. Moore, just returned from abroad, is interviewed by Miss Granbeck for WIRELESS AGE readers, to inform, suggest and entertain.

Fiction—Personality

"Classified Advertisement" is Buckley's latest—a zippy radio yarn. It is novel in style, quaint in humor and breezy in atmosphere. Listening to some dreamy melodies o'er the radio would be an excellent way to read it.

And the story of John Stone Stone pictures an outstanding personality who twenty-five years ago unraveled some of Heaviside's involved mathematics and helped develop the mathematics of tuned radio circuits to such an extent that radio could go to work for mankind.

Women's Appeal

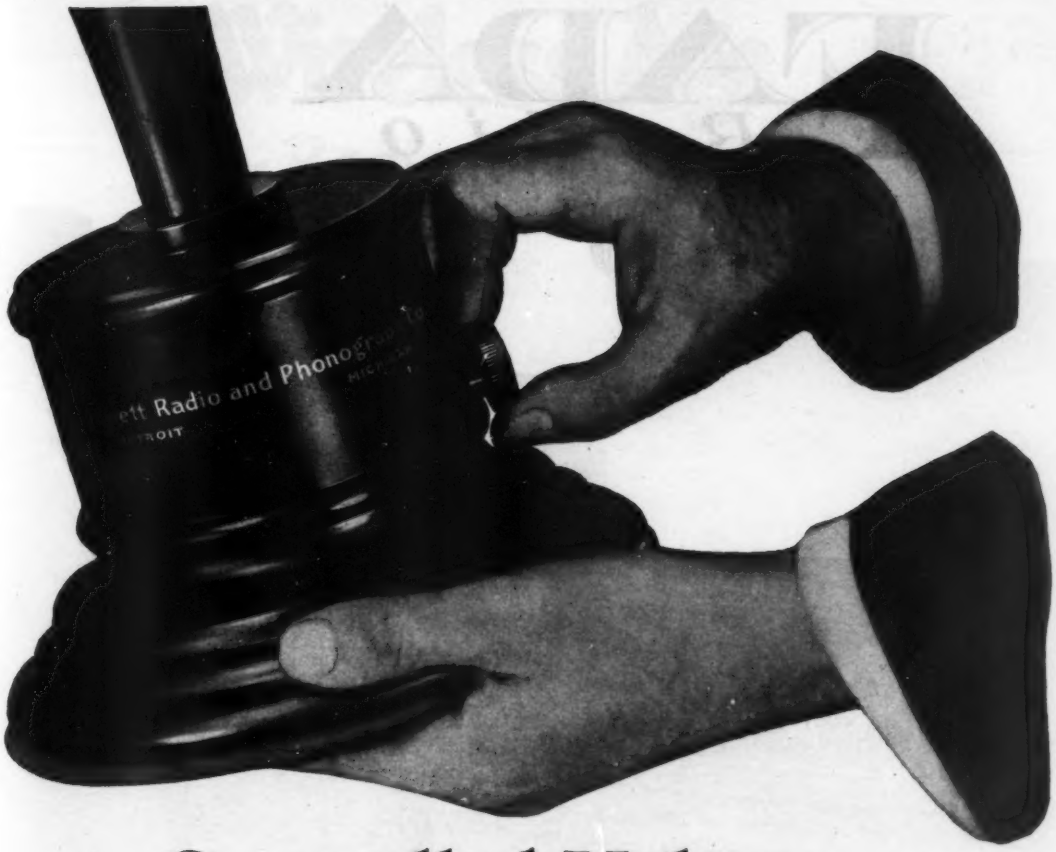
Go to school again via radio—that's what a great many women are doing throughout the country. "Radio Schools of Housewifery" tells you all about it—study courses, registration, examinations, graduations and certificates. Two million women are already attending radio schools—mayhap you'll want to join after reading this article.

Technical and General

Reduction of losses in receiving apparatus is a recent development. "How to Build a Very Low-Loss Tuner" will help you understand the theory of low losses and note the practice in construction of such receivers—Mr. Meagher's "One-Tube Transmitters" is as good as his "One-Tube Circuits" which our readers liked so well—"Modifying the Reinartz" reviews and stresses important phases of this circuit and includes an improved Reinartz receiver—More useful technical material will be found as you thumb through the pages—it is all up to WIRELESS AGE standard.

In addition you will find in this issue of WIRELESS AGE—THE RADIO MAGAZINE—articles of broadcast interest, news items, amateur and broadcast station lists and much more that is informative and entertaining—

But, by all means, don't overlook page 57—that is the departure this month, and if sufficient response is evidenced it will be continued. —THE EDITOR.



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Mahogany cabinet. Inclined panel and roomy battery shelf. 5 tubes. Price (less tubes, batteries, etc.) $160.

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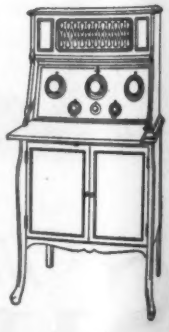


FADA Neutrola Grand No. 185/90-A
The five-tube Neutrola 185-A, mounted on FADA Cabinet Table No. 190-A. Price (less tubes, batteries, etc.) $270.

NEUTRODYNE

VOLUME 12

Wireless Age
The Radio Magazine

NUMBER 5

The studio of Radio-Paris

Radio-Paris

Plans to install 10-kilowatt equipment so you'll hear French programs when you wish—Broadcast conditions in France

By Miss Anne C. Granbeck

"AND how crazy did you find the French about radio?" I asked Capt. G. C. Moore, editor of the *Cavalry Journal*, Washington, D. C., who has just come from a visit to Paris.

"Would you believe it," he exclaimed in surprise, "the French have not yet really caught the radio fever!"

"But," I exclaimed in astonishment, "I have been hearing about the Eiffel Tower and other programs and I thought France was just as keen about it as the English and the Americans."

"Not at all," said my friend. "You can imagine how I—an American radio fan living in an apartment house in which eleven out of fifteen tenants have a radio set—felt when I heard not a comment during all my Parisian stay about radio. I positively had to use a pair of pliers to get any information on the subject."

"What's the matter?" I asked curiously. "Is it the broadcasting situation or the French character and point of view?"

"A little of both," replied Capt. Moore. "I learn that there are 400,000 sets in France now; but that, according to American standards at present, is not much; and when you analyze it still more closely, it is even less than it seems. The post-office department controls the broadcasting stations and fixes the wave lengths. There are, at present, only four broadcasting stations in all France—every one of them in Paris. You speak of Eiffel Tower, but 'Radio-Paris' is the principal one.

"You see," continued my friend, "it may not seem so strange when you consider that France is composed of two halves, figuratively speaking; one being Paris and its ultra-modern population, and the other rural France,

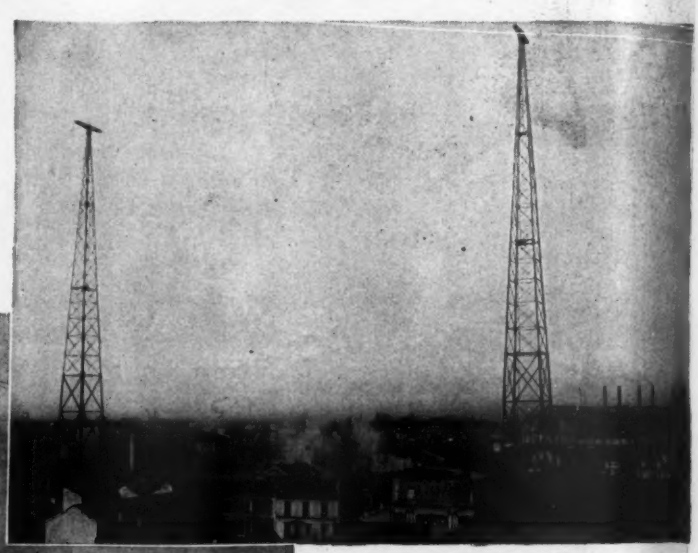
which is rather below the standard and alertness of our own rural sections and is rather indifferent to the ideas, foibles, and pastimes of sophisticated Paris. The French peasant stolidly plows his furrow and follows his traditional habits. It will, no doubt, be a long time before he is as alert to radio as our own farm country in the United States.

"That leaves us Paris, and you find in Paris a set of conditions making for the present at least, somewhat against radio. Their amusements for instance. We Americans have no idea of the enthusiasm with which Parisians follow horse racing. It is their favorite recreation. There are half a dozen courses about Paris, and races are going on every day. There is just positively too little about a horse race that you can broadcast, despite the ingenuity of our modern broadcasting. The French want to see the horses and expend their enthusiasm rooting for their favorite. That's that! Then you have, of course, a tremendous theater-going and music hall review or vaudeville audience. The congestion is so bad in the theater districts that theater prices, taxi-fares, etc., are distorted and the congestion very trying. Few Parisians dream of getting much entertainment via radio. He wants to be present at the theaters so nearby."

"But what about jazz, which I am told is taking all Europe by storm?" I asked rather curiously.

"Yes, it is true that radio stations are now broadcasting jazz—but notice how! The great new Chelmsford station in England gives a jazz concert twice a week, and the French broadcasting station 'Radio-Paris' catches it and re-transmits it! There is, of course, a fair vogue for this type of music and other music as well. But you never, by any chance, meet a real 'radio bug' among the French; they do not seem to have worked up any great enthusiasm at all. As a matter of fact, radio is having something of an uphill fight there. You see, France is amazingly political-minded—so much so that the primary usefulness of any radio station is believed by the French to be military and political, and thus they keep a strangle hold on it and minimize the importance of it for entertainment.

"I rather suspect," my friend went on, "that the intensely economical nature of the French has also something to do with it. I was walking in Paris one day and saw a little sign saying that radio programs could be heard inside. I went into the café, ordered a drink, and prepared to listen to some French broadcasting. But when nothing happened and I asked the proprietor, he told me nonchalantly, that he had taken out the apparatus because it was too expensive. He told me his hard luck story, and it illustrates what the French listener-in has to put up with. (And who shall say that we Americans wouldn't fret, too, if we had to indulge our radio appetites under the same handicaps?) He said the set cost him 1800 francs, the batteries 300 francs, a Government tax 200, and then 300 more francs as royalty to the Society of Authors and Composers, and then again a Parisian tax on radio sets costing 96 francs a year, which, incidentally, goes to the poor. Here we have about 2700 francs which it cost the proprietor to put in a receiving set for public use. He complained that it had not made any impression on his public, and, therefore, he had disposed of it. It discloses at once the official system in operation whereby the broadcasting or a fair part of it is supported by taxes on receiving sets. As a matter of fact, broadcasting does not profit by the taxation very much, since the tax for private receiving sets is low. The only thing that is keeping broadcasting alive is the fact that the banks are paying for broadcasting quotations to all their branches. The makers of radio equipment pay 'Radio-Paris'—the principal broadcasting station—according to the number of working people they employ, while the makers of tubes pay for each valve sold. 'Radio-Paris' receives only one franc on each receiving set used and gets a small subsidy through the Post Office Department. On the other hand, the artists are paid by the broadcasters and also receive royalties from the radio use of their plays and musical compositions."



Transmitting apparatus and antenna system of Radio-Paris station

"What kind of stuff do they broadcast?" I inquired.

"Operas, musical comedies, classical music, dance music and jazz. The opera situation there is not much different from here, as an organization of opera singers is preventing the broadcasting of high class grand opera; but still opera is the first preference on the programs of the broadcasting stations. But the service isn't good. The technical standards are not quite up to the quality of our best American stations. I don't know whether they have powerful enough stations or the most modern equipment, but at any rate, there's no comparison between the service of

some of our good American stations and that of even the best in Paris.

"This is militating against radio development in France. It seems that a considerable number of Frenchmen tried radio earlier in the development period and didn't like it much, and are now rather prejudiced. The broadcasting at first was pretty poor; the technical side was distinctly bad. So you have many Frenchmen saying radio is *'pas bon.'*

"Now, as in the United States, a livelier interest is being developed through publications. There are half a dozen or more weekly or monthly papers giving much space to radio, and there is a gradual increase in interest.

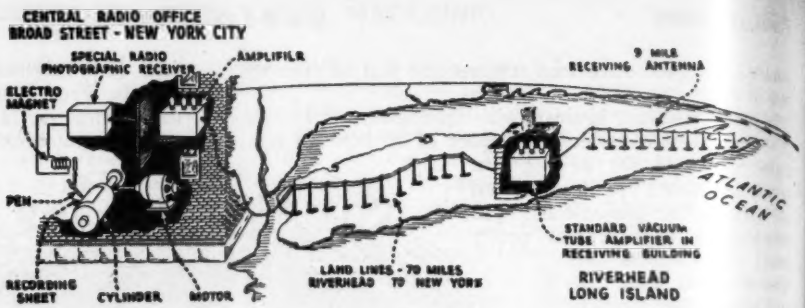
"The system of taxation of receiving sets is, peculiarly enough, divided into receiving sets installed for public entertainment and those used privately. The public receiving sets pay 50 francs in towns of less than 25,000; 100 francs up to 100,000; 200 francs for over 100,000. The little café proprietor, to whom I referred, living in Paris, although in an out-of-the-way quarter, nevertheless had to pay a big tax. The private receiving set is taxed a franc, and it is also illegal to radiate any wave that can interfere with neighboring stations or nearby receiving sets.

"The French now recognize that further development of broadcasting is desirable; and the Government's Committee is interested in the profits which radio is capable of producing, and thus providing revenue. It has now reached the conclusion that the commercial development of broadcasting stations is much to be desired, and is encouraging the three new stations which are going to be built next year at Lyons, Marseilles and one other place. The Government will pay something toward the expenses for the transmission of reports and communications and has even promised to endow hospitals, schools and country communities with receiving stations. The licensing of broadcasting stations is to be governed by a technical and administrative and financial committee and each case is to be judged separately. Amateur transmitting stations are limited to 100 watts, with a wave length of from 100 to 200 meters. Only the holder of a radio operator's license may operate a transmitting station. An examination is given at the applicant's home by a Government agent, and

Gabriel Germinet—prominent radio playwright of France

(*Turn to page* 87)

Photoradiogram of President Coolidge transmitted from London



THE PHOTO-

It is now possible to trans- on one side of the world to people

By K. M. MacIlvain,

PRECEDING radio achievements must fade into the background and give way to the epoch making event which took place Sunday, November 30th, 1924, when Captain R. H. Ranger of the Radio Corporation of America demonstrated the feasibility of transmitting pictures across the Atlantic Ocean.

It is now possible to transmit pictures of happenings on one side of the world to people on the other side, without the aid of any metallic connecting medium. A picture can be taken in London of an event of universal interest and transmitted to New York so that within a few minutes from the time the picture is taken in London, it is available for our perusal here in New York.

An analysis of the many attempts of others to solve the same problem, indicated that one of the chief difficulties was more a question of economics than engineering. Thus the nature of the problem made it necessary, for anyone attempting its solution, to not only have an inventive slant, but to be a mechanical engineer, an electrical engineer, an economist and an expert photographer imbued with an artistic temperament, as well.

In view of the quite generally prevalent fact that the most economical method of transmitting intelligence from a point on one side of the world to another point on the opposite side, is by means of the radio telegraph systems, the logical method of procedure was to devise some scheme whereby pictures could be interpreted in terms of dots and dashes. This is exactly what was done and the pictures that are being sent by radio across the Atlantic at the present time are composed of dots and dashes, the tonal value being brought out by the length of these dots and dashes.

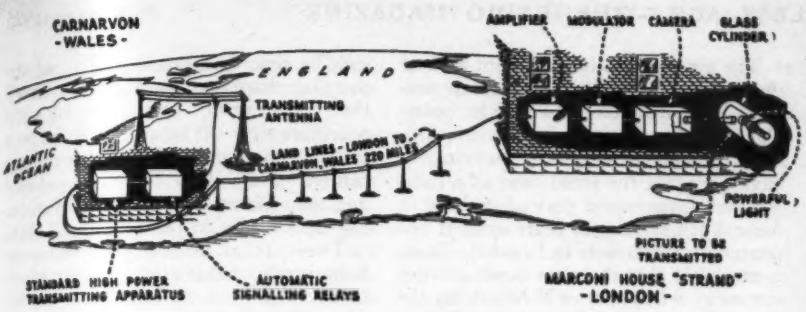
It might be of interest at this point to suggest a theory as to why previous systems, which had been capable of showing very good results over land line circuits, had failed over radio circuits. Some of the best schemes for transmitting pictures between two points which were connected by wires were based on "intensity." That is, the variations in the intensity of the operating current brought out the tonal values in the received picture.

It is one thing to control the signal intensity down to the *n*th degree over a short stretch of land lines and another to execute the same degree of control on the intensity of signals to be transmitted by radio and received at a point over 3,000 miles away.

Today you see proof of the feasibility of transmitting pictures by radio over thousands of miles of land and water and most of you probably realize the untiring effort that must have been maintained by those interested in the success of the undertaking, the obstacles met and overcome, the disappointments finally culminating in success.

At the receiving end in New York were E. F. W. Alexanderson, R. H. Ranger and Charles H. Taylor, all R.C.A. Engineers

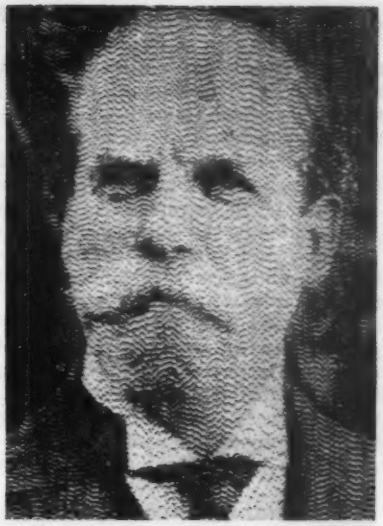
Captain Ranger has been working on the perfection of this system for only a number of months, however, which is a surprisingly short length of time considering the magnitude of the accomplishment. Last summer the system was perfected to a degree warranting its application to a local radio circuit. Consequently, the output of the photographic transmitting apparatus in Captain Ranger's office was plugged in on the land line running out to



RADIOGRAM

mit pictures of happenings on the other side by radio

R. C. A. Research Engineer



Photoradiogram of Secretary Hughes sent to New York from London

one of the Radio Corporation's transmitting stations. The dots and dashes sent out over the control line from the photo-transmitter operated the control relays at the transmitting station which controlled the output of the transmitter. These dots and dashes were picked up at the company's receiving station at Riverhead, Long Island and piped in to Captain Ranger's office at 66 Broad Street, New York City. A summary of the local circuit, then, was from the New York office to the high power transmitting station by land line, to Riverhead, Long Island, by radio, and then back to the New York office by land line.

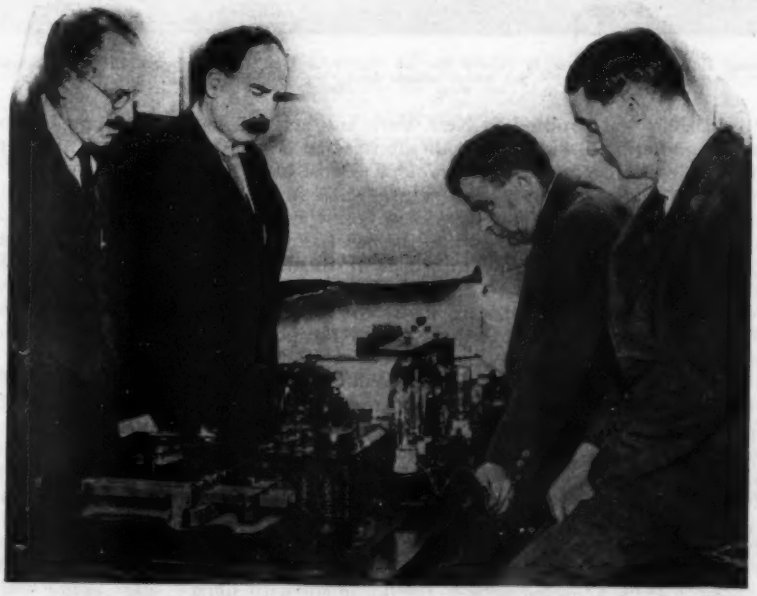
Later, the development reached a stage which warranted its application to a transatlantic radio circuit. An immediate test was desirable but there was only one photographic receiver and it was located in the New York office. This prohibited the transmission of pictures from the United States to Europe, immediately, but Captain Ranger said, "What is to prevent our transmitting a picture to England and retransmitting it so that we may receive it here in New York?"

This was a novel way of utilizing the facilities available at the time and the plan was immediately put into operation. The photographic transmitter was plugged in on the control line to the Radio Corporation's high power station at New Brunswick, New Jersey, and the picture modulated radio-frequency waves were sent on their way to England. These signals were received in England, amplified, rectified and made to operate a relay which in turn operated the control relays at the Marconi Company's transatlantic radio transmitter at Carnarvon. The dots and dashes transmitted from Carnarvon were picked up at Riverhead, Long Island, and piped over the land line to New York where they were translated back into the picture from which they emanated.

The results at this time were very satisfying and seemed to indicate that the development had reached a point where it was possible to give a public demonstration.

Finally, in November 1924, Captain Ranger was satisfied that the time for the demonstration had arrived. Consequently, early in November, Mr. Donald Gordon Ward, one of the engineers of The Radio Corporation of America, left New York on the Majestic, bound for London, England, with the photographic transmitting apparatus, to install it in the London office of the Marconi Company. When this had been accomplished the first pictures of the initial transatlantic test started coming in during the wee small hours of Thanksgiving morning.

The first one was a photograph of a radiogram and all the details were reproduced faithfully. The first portrait to come through was that of the inventor himself, Captain Ranger. The moment his likeness was registered on the recorder paper, the success of the undertaking was assured. It was remarkably clear and distinct. A picture of President Coolidge came through next, and one of Secretary Hughes followed immediately after. An old Chinese proverb, "one picture is worth 10,000 words" was quite appropriately sent through next. These pictures all came through in rapid succession. There were no intermediate tests or adjust-



Donald Gordon Ward, R.C.A. Engineer, who traveled to Europe to handle the transmission, and G. S. Whitmore, Director of Communications, observing the test

ments necessary. Once transmission was started Thanksgiving morning, the pictures came through with the utmost regularity.

The public demonstration was set for the following Sunday, November 30th and the photographic receiver was in operation at all intervals between Thursday and Sunday when the English transmitter could be relieved from regular traffic to transmit pictures.

By special arrangement the photographic receiver was kept in constant operation from early Sunday morning until late that night. The many notable engineers and business men who had been invited to witness the demonstration began arriving at the New York office about 10 o'clock in the morning. Another notable gathering in the London office of the Marconi Company was watching the photographic transmitter function.

An editorial which appeared in one of the New York newspapers after the demonstration quite aptly termed it "a real miracle." There were no special conditions required and absolute proof was available as to the reality of the miracle.

One of the pictures which came through during the demonstration was that of the finish of a race between Oxford and Cambridge which took place in England the day before the demonstration. This picture was transmitted during the demonstration on Sunday and was reproduced in the New York morning papers on Monday. Thus a picture of an event that took place on Saturday in England was printed in the New York papers within 30 hours.

The above gives only a slight idea of the speed of the photoradiogram service. For instance, it would be possible at this early stage in the development of this new type of service, to have a copy of the front page of a London newspaper or a part of it, here in New York within an hour after it appeared on the streets in London. There is no doubt that the time is not so very far away when they will be selling the London papers on the streets of New York within an hour or two after they appear on the streets of London.

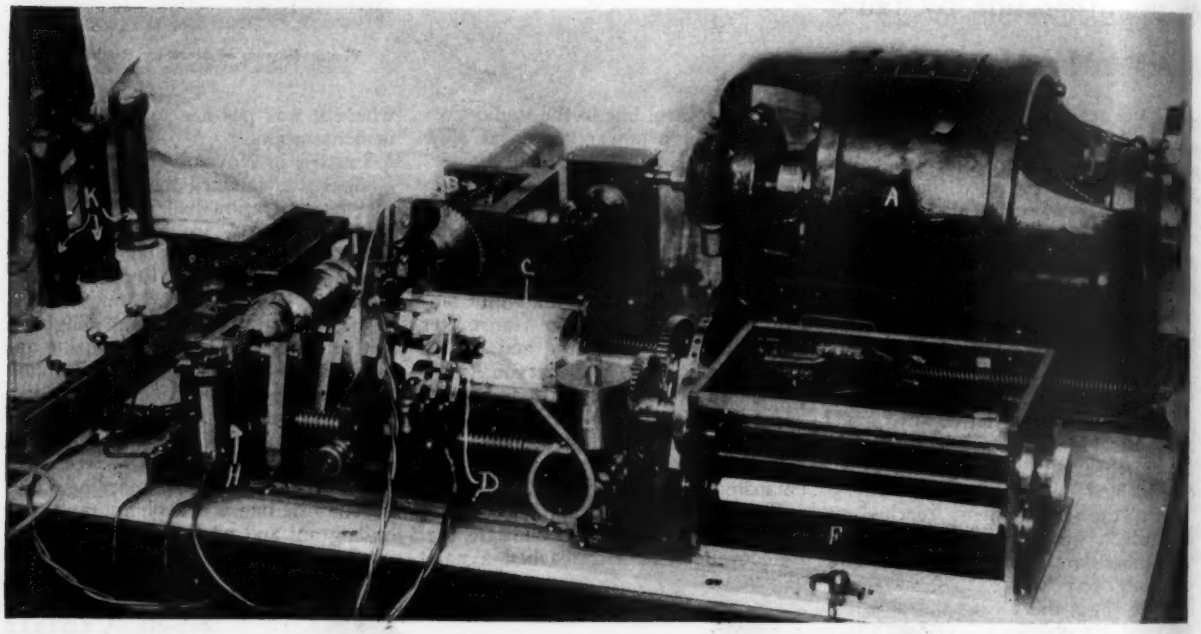
Another very interesting picture that came through was that of the group of people around the transmitter at the London end. The picture was transmitted to New York and arrived here within an hour after it had been taken in the London office. Most of the persons in the picture were strangers to the engineers here on this side but there was not the least doubt in the world as to which of them was Mr. Ward.

There are many things which have been made possible by the photoradiogram service. A document in London which needs the signature of a man in New York could be sent to New York, signed and returned with the signature attached, all within a few hours time. A photograph could be made of the document in London and this photograph transmitted to New York. The print available in New York after transmission could be signed by the desired person, the document with signature attached photographed and this last photo retransmitted to London.

The technical side of the subject may be described briefly. The accompanying diagrams show the layout of the transmitting and receiving end schematically. Whatever is to be sent is first photographed on an ordinary camera film. This film is developed and then placed on a glass cylinder, being held firmly in place by metal clips.

There is an ordinary incandescent lamp inside of this glass cylinder which is focused in a minute beam on the film. To effect transmission, the cylinder is set in motion and as the light and dark portions of the picture are traversed by the light beam, the intensity of the ray which penetrates the film is changed. This ever changing beam after having passed through the film is again focused on the sensitive element of the photo-cell, which transforms the light rays into electrical impulses.

The resistance of the photo-cell varies in accordance with the amount of light which strikes it and in this way the light rays which penetrate the film are changed into electrical impulses. There is practically no lost motion in the functioning of the photo-cell; that is, the current in the output circuit of the photo-cell changes the instant there is the slightest change in the amount of light striking its sensitive surface. In order to cover all of the film which is undergoing transmission, the glass cylinder is rotated back and forth, and in this manner the entire surface of the film is eventually exposed to the piercing light beam. The film rotates through an angle equal to the width of the picture and the photo-cell carriage itself advances down the length of the



The receiving apparatus—the cylinder C oscillates to receive the ink record as well as to produce the film record. At the right (A) is the motor which drives the cylinder

picture, one notch at a time. Thus, line upon line, the whole picture is covered.

The variations in the photo-cell output circuit pass through a suitable amplifying system and are then fed into a modulating device for transmission. The electrical interpretation of the picture is then transmitted over land wires to the radio transmitting station. In the case shown in the diagram there was a land line stretch of 220 miles from the London office of the Marconi Company to the transmitting station at Carnarvon, Wales. Here, the dots and dashes coming in on the control line from the photographic transmitter in London, were made to operate the relays which controlled the transmitter output.

We have heard of "voice" modulation and "telegraph" modulation, and now we have "picture" modulation, because that is the type of CW wave which is sent out from a high power transmitting station which is controlled by a photographic transmitter. The dots and dashes sent out from England were picked up on one of the nine-mile receiving antennas of the Radio Corporation of America at Riverhead, Long Island. They were amplified, heterodyned and detected and put on the land line to the New York office in the form of audio-frequency dots and dashes.

The photographic receiving apparatus in the New York office decoded the complex photo messages which were transmitted from England and each dot and dash performed its function.

The paper on which the picture record is made at the receiving end is wrapped about a rotating cylinder which greatly resembles the early type of phonograph record. A specially constructed pen marks on this paper as the cylinder rotates back and forth. The markings of the pen are controlled by the incoming signals and the fineness of the dots and dashes recorded on the paper—due to the high rate of speed at which they are sent—gives an artistic effect to the picture, greatly resembling stippling.

Besides the visible ink record there is a duplicate record being made on a sensitive film inside of a dark box. This double record eliminates the uncertainty of the photographic record alone. If the picture were being received on the film alone, it would be impossible to tell how the picture was coming through until the transmission had been completed and the film developed. The ink record which is being built up progressively and visibly, tells the story as to how the picture is coming through, long before it is completed. If it is too dark it can be noticed immediately and the operator at the transmitting end informed so that he may make the necessary adjustments without stopping or repeating the picture. This has been found to be a great help in saving time and expense.

At the completion of the transmission of a picture, the film is developed and any number of prints can be made from it. The original ink-record can be photographed if desired and any number of prints made from the film thus obtained.

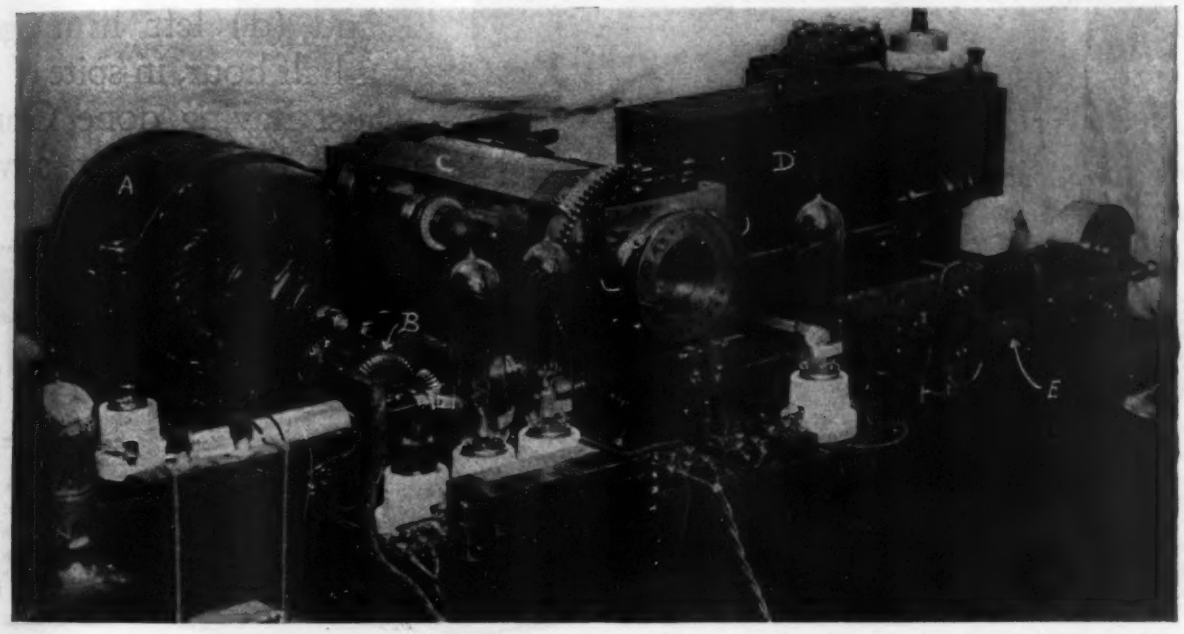
Officials of the Marconi Company in London were quick to declare their belief that the system will become capable of commercial application in the near future.

They outlined the immense possibilities to the group of English and American correspondents who stood by with G. S. Whitmore, Marconi communications engineer, while D. G. Ward for the engineering department of the Radio Corporation, operated the intricate and semi-secret device.

Other English and American papers were permitted to send one picture each and for general distribution pictures of Ambassador Kellogg, Queen Mary, Owen D. Young, Westminster Abbey, St. Paul's, the Nelson Column in Trafalgar Square and a group photograph of the correspondents watching Ward were flashed through space.

The demonstration closed with an expression of regret by Whitmore that the limited time available for installation of the apparatus did not permit using the special device by which the photographs sent from London could be immediately flashed back from New York. He said such a device has already been perfected.

This wonderful invention has created world-wide interest. There is no doubt that it holds the center of the stage of radio science at the present time and that the system will be developed to perfection in the months to come. With the practical development will come a commercial value that can barely be estimated at the present time and a new use of radio will have become established.



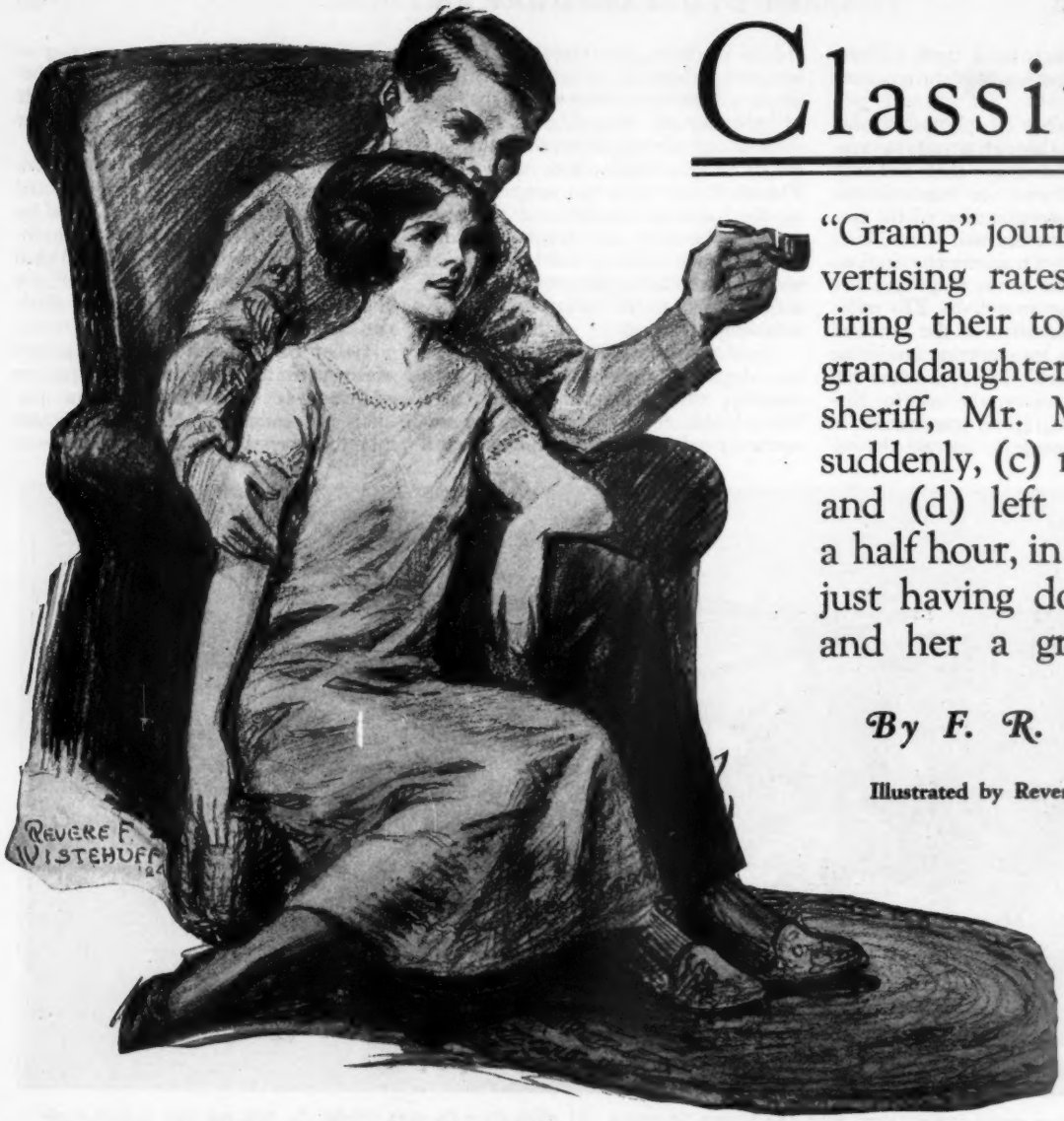
The transmitter—a special constant speed motor (A) actuates the gearing (B) which drives the glass cylinder (C) back and forth in front of the photo cell camera box (D). Magnets (E) advance the camera box (D) down the length of the glass cylinder to cover the complete picture rotating on the cylinder line upon line

Classified

"Gramp" journeys to Red
vertising rates, to set a
tiring their tongues won-
granddaughter (a) mar-
sheriff, Mr. Mac Gregor,
suddenly, (c) returned to
and (d) left him again
a half hour, in spite of his
just having done Gramp
and her a great service

By F. R. Buckley

Illustrated by Revere F. Wistehuff



"He'll have me, and I'll have him; and we'll both have the radio for outside company"

IT may be considered good manners here in Red Dog, but in the township where I own five thousand acres any newspaper editor who received a stranger with a shotgun across his knees and two compositors in the background all ready to hurl type-metal, would be socially ostricheyed, and serve him right. As anybody who saw me in town the other day can bear witness, I am at least sixty-seven years of age, and look more; and if I did happen to be carrying two revolvers and a rifle, I can give an excellent reason for it; viz., I had driven all the way down in a flivver at fifty miles an hour, and it had seemed to me I might maybe run over a jackrabbit or something and have to put the poor animal out of its misery.

DRINK "TROMBONE." It slides down.—Advt.

My mission in Red Dog was not only peaceful, but in the nature of a public charity; I having heard that various persons with nothing else to do, were tiring their tongues wondering why my granddaughter (a) married your sheriff, Mr. McGregor (b) left him suddenly (c) returned to him again a week later and (d) left him again suddenly within half an hour, in spite of his just having done her and me a great service.

Admitting that these proceedings might look a bit strange to persons unused to minding their own business and keeping their faces closed, I aimed to drop in on those who had been talking, and explain matters. Finding that all these gents had either left for parts unknown, or were just leaving for them in clouds of dust, I naturally dropped into the office of this newspaper to see if I couldn't do my explaining in print, so that he who ran might read: and here I am doing it—at advertising rates.

I don't mind the money; I don't even mind having this here literary production classed with and stuck down among the classified advertisements; but the editor's suspicious attitude certainly does stick in my craw.

Way he talked and handled that shotgun, honest, you'd think it was yesterday I killed the four Watson brothers, instead of thirty years ago.

Well, that's enough about my own personal griefs. Now for the explanation about my little girl and her husband.

IF BRITO will clean dirty nickel-ware, won't it do the same for your teeth? Six bits. Wilson's Drug Store. —Advt.

I don't know to this day why Mary chose to teach school; or, anyhow, why she should have picked on a scandal-mongering dust-heap like this town to do it in.

Advertisement

Dog and breaks into print, at ad-
rest various persons who were
dering why his
ried Red Dog's
(b) left him
him a week later
suddenly, within

She is kind of independent in her mind, and not fond of explanations, which is why I'm having to do all this writing. She just looked up from a book one evening back there at the ranch, and remarked that she'd got the job; and similarly, after she'd pumped knowledge into the Red Puppies for a couple of months, she strolled in one afternoon when I figured she was seventy miles away, and said:

"Well, Gramp, I'm going to marry a man."

ARE YOU DEAD? Let me bury you. Woburn's Parlors, 14 Marginal Street. Phone Connection.—Advt.

Just for the minute, waking up from my after-lunch doze with my spectacles way out of place, I figured she must be joking.

"Oh, a man, eh?" says I lightsomely, trying to adjust them, untangle my newspaper, and feel for the makings simultaneously. "Now, that's funny. I've always made a point of marrying women, myself."

Saying which, I got my glasses on, and perceived she was in sober earnest.

"You don't mean to tell me," says I, "that he's a *real* man?"

"He's the sheriff of Red Dog County," says Mary casually. "An imitation wouldn't last there very long."

"Has he got a name?" I inquired, after a pause of reflection.

"Angus McGregor," says Mary. "He's of Scotch descent."

"That's a big load off my mind," says I. "For the moment, I feared he might be a Chinaman."

"No," says Mary gravely. That's a funny thing I've noticed about people in love, by the way. You can guy the stuffings out of the person uppermost in their minds, and they'll never crack a smile. To use a radio expression—I'm coming to radio in a minute, so I may as well get the good of it now—the aforesaid is in fact quite a sensitive test.

GRAPE JUICE for sale, first class, beautiful stuff, fit for angels, $1 per gallon. Ditto, spoiled by being kept too long, $5 per gallon. H. Jones, Respectable Farmer, RFD 6.—Advt.

I perceived Mary to be, in short, considerably stuck on this "Hoot Mon!"

Yet obviously there was something on her mind.

"The only thing that has been worrying me," she remarked, "is how I should keep my sanity, living in that perfectly awful town. Gramp, you've no idea. You never did, in all your life, see such a horrible, dull, dismal, brutal, vicious, ugly hole as Red Dog."

I am sorry to be putting these words in the *Red Dog Weekly Howl*; naturally, I'd have suppressed them, if I'd been given the courtesy of its columns. As it is—truth is mighty, and will prevail.

"Except Angus, there isn't a man in the town who hasn't got legs like the frame on an oval mirror," Mary went on, "and as for the women—the nearest thing to sociability they ever pull off is a weekly reputation-murdering, called a sewing-circle."

"The best thing you can do," says I, wagging my head joyfully, "is to stay at home with your old Gramp. There's a pair of socks in the bureau drawer, now, Mary—"

"I thought so myself," says the girl reflectively, "until Angus figured out a solution. He's slow, Angus is, and he doesn't say much; but he has awfully good ideas. He's going to buy a radio; and then we'll just cut local society out. He'll have me, and I'll have him; and we'll both have the radio for outside company."

There was kind of a lyrical lilt to her voice which warned me that it was all settled, and that I'd better save my breath to get into my boiled shirt with.

"Have you ever heard a radio?" I inquired.

"No," says Mary. "Have you?"

"No," says I, thus failing to break the deadlock.

She came over and kissed me on the top of the head.

"Wedding's tomorrow at four o'clock," she said rather breathlessly. "You're going to give me away. Oh, Gramp, I *do* love him a lot; and I *am* so happy."

FOR SALE, Model 1911 Detroit Four touring car. Good rubber ¼ way around. Original engine. Good practice for buckjumper. Offers under five dollars save stamps. N. Brewer, M.D., Three Pines.—Advt.

So far, so good; in fact, we went a whole lot farther than that without running into any very considerable disadvantages. I made inquiries of various persons concerning this Angus McGregor; found he was generally considered a remarkably level-headed, regular living, reliable young man and a first class revolver shot, which indicated that he wouldn't be throwing any widows back on my hands; and accordingly, I graced the wedding with my presence—in fact, the ceremony was pulled off in my house.

Mr. McGregor, judging by what I could see of him over my starched collar, had a good, earnest face, and he wasn't one of those brash kids that talk all the time, either. Far from it. Almost too far for my taste. To tell the truth, the remark of "Yes" at one point of the marriage service was about all the chatter he hazarded until 'way along about the end of the afternoon, when he chanced to meet up with a fellow named Wilkinson, from Longhorn City. I was passing by with two cups of coffee in each hand when they started to talk—Wilkinson was just mentioning a mutual friend they appeared to have named Mike O'Farad; and from then on, their conversation was fast and furious. They had been talking, not to mention drawing diagrams, for all of two hours and a half, when I went out on to the verandah to cool off, and found Mary standing all dressed in her traveling clothes, tapping her foot on the boards and looking impatient, to say the least of it.

"Why," I inquired, "what's the matter?"

After saying "Nothing—nothing!" the way women always seem to feel bound to do, it developed that she and her new husband had had it all fixed up to skip out of the proceedings while the guests were occupied with the eats; thus escaping the shower of rice, confetti, old boots, and horseshoes usual under the circumstances. It further developed that the bridegroom, in the stress of his conversation with Wilkinson, had forgotten all about this arrangement.

"I know that we are married now, and that therefore I can't expect the same politeness as formerly; but I should be obliged," says Mary, "if you would drop in, Gramp, and remind Mr. McGregor of my continued existence."

I did just that; but unfortunately, he and Wilkinson were so absorbed in drawing pictures of a new aerial or something—it was radio they were discussing—that I had to speak rather loudly; and that kind of gave the alarm to the assembled guests; and naturally, to make up for nearly having been cheated of their sport, the aforesaid guests threw more rice and assorted bric-a-brac than they had originally intended to. Two Toes Trotter, who must have brought his own with him, actually got so enthusiastic as to throw half a roast chicken.

Well, this was on a Thursday; and those who have had their only female relatives married away from them will sympathize with me when I say that by the Thursday following, I was just about ready to drop over to Red Dog and see Mary again; incidentally diagnosing as far as possible whether this marriage looked like turning out to be a success. It was a nuisance getting my black clothes out of the mothballs again so soon; I got nearly frantic looking for my collar-buttons; and you may imagine it didn't make me feel any better, just as I was straining my heart over the crank-handle of my flivver, to look up and see the station jitney arriving with Mary herself—and all her trunks.

All the boys had come out of the bunk-house to hear me talking to the car, so I couldn't say anything to her then and there. And by the time I reached the ranch-house living-room, my granddaughter had already commenced a kind of oration. The Longhorn City *Clarion* was lying on the table, open at a full page advertisement of somebody's Super-Resistodyne, and as far as I could judge by the way Mary was tearing the page to pieces, it must have been this that set her off.

"WJZ! KDKA! 2LO! WEAF! WGY!" she was saying, more or less hysterically, if you know what I mean. "This is Uncle Bunny, darlings! Uncle Bunny, of the Texas State Agricultural Experiment Station. It's hot weather in Miami, Florida, and the prune crop is expected to total six hundred thousand cases."

Having said this, she picked up a small, but solid chair and heaved it through a window; after which she tore off her hat, threw it into the fireplace, looked at me helplessly for several seconds, and finally burst into tears.

If you have read F. R. Buckley's "Per Land Line," "Alias Slimmy O'Dyne" and "DX—A Yuletide Story of Radio," already published in Wireless Age, you'll surely enjoy the quaint humor in "Classified Advertisement." Describing some of the complications in urban life caused by radio finds Buckley at his best

Tact is the thing at a crisis like that. I went right over and started patting her gently on the shoulder.

"The radio," I said soothingly, "has been getting on your nerves, for some reason or other."

"Some reason or other!" she bursts forth, jumping up with her hands clenched and her eyes blazing. "He spends the entire first week of our marriage listening in on the infernal thing; wakes me up at 4 a. m. to tell me he's got Honolulu, and then you say 'for some reason or other!'"

She did a couple of gulps.

"I went out for a walk this morning to think it over," says the poor child tremulously, "and I came back, and I said 'Angus; you can choose between that thing and me!'"

She sat down on the sofa and buried her face in her hands.

"Well?" says I, after a decent interval.

"He held up one finger," says Mary, "and s-said 'B-be quiet a minute! I'm getting P-P-Paris, Fuffuffrance!'"

Well, sirs, it made my blood boil, I started for the door.

"He'll get Gehenna, Hell, soon's this Ford'll start," I remarked through my teeth; and went out onto the piazza only to come face to face with the culprit himself.

Judging by the looks of himself and horse, he had raced the train from Red Dog to my place—carrying weight, too; a long black box across the cantle of his saddle. For a couple of moments we looked at each other.

"Well?" says I.

"Mary here?" says Angus McGregor.

"Have you come," says I, "to do your duty, and swear off that home-breakin' machine I see you are packin' along?"

"With an ax," says Angus.

"Inside," says I, jerking my thumb over my shoulder, and starting off for a nice walk so's to leave a clear field for the reconciliation.

A word in your ear. St. James' Oil.—Advt.

Well, he smashed the radio all over my hearth-rug, so that I got splinters of glass in my soles the very next time I took my shoes off; but Mary didn't go back to Red Dog with him that evening.

"He gave me a week of unhappiness," says Mary, when

I expressed some surprise at finding her alone in the ranch-house on my return. "A week for a week, Gramp. I'll go back next Thursday. Not before."

NOTICE. The man who put the cockleburr under my saddle last week is known, I advise him to laugh all he can while he still has a face; signed, W. Besnan.—Adv.

Well, now we come to the part of this story which is hardest for me to write, however easy it may be for a lot of impudent young persons to read.

On the following Monday, a citified looking fellow with a kind of terrified look in his eyes and mud all over him from top to toe, came staggering into the ranch-house about 7 p. m., and said that the motorcar of his employer, Mr. Henry J. Davidson, of New York City, N. Y., was stuck in a stretch of gumbo five miles down the trail.

"You'll have to get a dozen horses at least," stammers this secretary-person, or valet, or whatever he was. "We were hurrying to—we were hurrying, and we're in over all four wheels. You'll have to hurry."

I didn't care for his manner much.

"Who says so?" I inquired.

"A hundred dollars says so!"

And, since the money was right there to speak for itself, of course there was no further argument. I roused out the boys, took fifteen horses and a stump-puller; and, to cut a long and muddy story short, it was barely three hours before we had Mr. Henry J. Davidson drying himself externally with fire, and warming himself internally with whiskey, in my ranch-house living room. He was a very different sort of hair-pin from his secretary; a great big, bluff, handsome guy in a fur coat, regularly exuding health, wealth and happiness—especially wealth. The car was one of those four-thousand-dollar racers with two seats and twelve cylinders; its owner was wearing a four or five-carat diamond stickpin; and there was also a morocco leather handbag thing large enough to hold a million dollars in paper money, which Mr. Davidson politely, but firmly refused to let out of his own hands.

"—— he having poured all his drinks into a potted plant, as I found when the plant died"

"I can't thank you enough for pulling me out of that hole," he said, shaking my hand heartily. "Business is a hard master, you know; I was driving pretty fast—due in Mexico to close a big deal tomorrow afternoon at latest; and that stretch of gumbo didn't look half as sticky as it was."

"And it wasn't half as sticky as a dozen or so you've got ahead of you," I told him.

His jaw dropped.

"Are there any more of those—those man-traps on the road?" he asked.

"About twelve or fourteen," I told him. "And the only way you can avoid 'em is to keep a sharp eye out, and turn off the road on to the prairie when you see one."

"But," says Mr. Davidson reflectively, "you can't tell them from solid road at night."

"Which was just why I was figuring to ask you," says I, "to stop here the night, if you cared to."

He glanced at me sharply, and hesitated.

"We haven't ever murdered a guest for his money here yet, that I remember," says I reassuringly, "but if you feel that a gun would be of any comfort to you during the long night hours, I can supply you with a couple, and there are bolts on all the bedroom doors. The fact of the matter is, my granddaughter and I are more or less cut off from the world down here, and we occasionally crave a little conversation."

"Haven't you got a radio?" says Davidson, smiling at Mary, who had just come in, as if he approved of her highly. I have since learned that it was this smile that decided her to go to bed. At the time, I thought it was the mention of the toy that had wrecked her home.

Anyhow, she went; and Mr. Davidson and I proceeded to spend a congenial evening. He was kind of cagy and high-financierish at first; but as time and the bottle passed, he loosened up and became very human, not to say confidential.

"To tell you the truth, old man," says he, about 2 a. m., speaking in a thick and affectionate voice which was peculiar, he having poured all his drinks into a potted palm, as I found when the plant died, "to tell you the honest truth, I'm going into Mexico for nothing but bribery and corruption. But what's a man going to do? When there's fifty million dollars' worth of petroleum a hundred yards the other side of the border, and I can get control of it by paying an official a mere five hundred thousand—I'd be a fool not to do it, wouldn't I? I'll say I would. Imagine it—right near the surface. A well fifty feet deep'd strike a gusher, I really believe; twenty-five miles of pipe-line'd hook us up with the Trans-continental—and there we are!"

"Gosh!" says I, trying to remember the copy-book maxims about easy money being something to run away from with all four feet.

"The only thing that's worrying me," says Davidson, appearing to put another drink where the rest hadn't gone, "is this—you'll think it's kind of silly; superstitious; but I've followed superstitions all my life, and if you were to ask the First National Bank of Chicago or the Central National Trust Company of New York, I guess they'd say I haven't lost by it. Well—this is it—there's thirteen

(*Turn to page 78*)

Around *and* About *the* Golden Gate

Meet some of the regular feature artists broadcasting from the Pacific coast stations

By Dr. Ralph L. Power

FROM the simple life in the backwoods country to the rigorous and strenuous daily existence in a big city without losing her youthful charm and vigor has brought to Olive Ann Alcorn the title of "the most perfectly molded girl in America."

Miss Alcorn delivered a series of fifteen ten-minute talks through KFI in Los Angeles last year and told radioland how to reduce, or grow fat, and gave exercises. The talks provoked considerable favorable comment from fans everywhere and she was called to speak before more than a score of women's clubs and similar organizations up and down the Pacific Coast. And several vaudeville engagements resulted from her radio talks so thousands have also seen her dancing interpretations on the legitimate stage.

But Olive Ann thought she owed a big debt to radio and realized that she couldn't entertain radioland forever by talks and they couldn't see her dance. So she studied voice culture for months and now she has leaped into radio's limelight as a singer having made her début as a soloist at the Los Angeles radio show in December when *The Examiner* broadcast its programs from the exposition.

All of which brought her to the attention of influential movie directors and now she has signed to appear in a series of two-reel films in which America's "most perfectly molded girl" will appear in important rôles.

Certainly radio has held its thrills for Olive Ann Alcorn and it has brought to her the fulfillment of her life's dreams.

EVER on the lookout for the new and novel stunt, KHJ in Los Angeles, recently presented something decidedly unique. With the assistance of the Hollywood Record Company a complete machine for the making of records was taken to the studio and used during the children's hour.

Little Queen Titania, "The Fairy of the Microphone," has appeared for 67 consecutive Tuesdays at 7 o'clock in *The Times* studio, and has established an enviable record. So Titania was seated before the microphone where she read some selections as she always does on the Tuesday evening program. While this was taking place the recording machinery started and the story was on the recording disk in a jiffy.

Dean H. V. Carpenter, "the man behind" KFAE

When little Titania stopped speaking the needle was reversed and radioland heard the words repeated—coming the second time from the machine record. The recording was so perfect that the listener-in was unable to distinguish the actual voice of the little Queen and the record.

During the Los Angeles Radio Exposition Titania met many of the radio friends she has made in the past fifteen months and autographed hundreds of photographs. Her trip to the studio each week with the "Radio Fairies" and the selections from the "Fairy Library" delight thousands of kiddies far and near. Her little book is just off the press and it puts in permanent form much material that has been given during the children's hour.

WITH the constant endeavor to give the best in drama via radio, stage props have undergone radical changes. Radio drama, to be successfully transmitted, depends to a large extent upon sound property. Probably nowhere else in radio broadcast programs is the ingenuity of the staff taxed so much as in this important feature of the work.

Wind has, of course, been simulated with dried peas being rolled through a paper tube and the same realistic effect may be brought out by dropping peas on a drum head. A wind sheet for a gale, a vacuum cleaner or electric fan to bring out the flight of an airplane or automobile have also been used with almost immediate success.

Edward Murphy, director of the Community Broadcasters in Pasadena, California, recently put across a remarkably successful playlet depicting life in an orange grove—a program broadcast for one of the fruit growers' organizations of Southern California. This began with planting, irrigating and cultivating the orange grove, spading, pruning and picking the ripened fruit. A couple of buckets of water poured back and forth supplied the irrigating effect, a flat of dirt with a hoe gave the sound of cultivating the ground, breaking tree branches did for the picking of the fruit, and so forth.

Radio studio props include every conceivable thing—sirens from police motorcycles and fire engines, gongs and cash registers from the street car companies, wind mills for Dutch scenes, and the water scenes to simulate dripping caves or coal mines. In short, the average studio rapidly accumulates a fine assortment of props without much difficulty.

An excellent forest fire is made by means of a blow torch. The breaking of matches and the crushing of paper give the effect of rushing wind and flames.

It is practically certain that the children's hour of the future will depend more largely upon props than it does now. Color will be lent to the setting by means of properties such as the cuckoo or singing of birds to go with bird stories, the time honored "grunt" made with a lard pail and used in side shows to give wild animal calls, and other devices.

Golden Gate Entertainers

Queen Titania of KHJ, who has appeared in the Los Angeles Times studio for 67 consecutive Tuesday nights during the children's hour program

Olive Ann Alcorn, in her new role of soloist, sings to the audiences of station KFI

"America's most perfectly molded woman," Olive Ann Alcorn, originally perfected reducing exercises and gave them to radioland from Los Angeles, but more recently her charming songs have entertained broadcast audiences

Action is created and simulated by sound—the device varying with the needs of each production. While screen acting made immense and radical changes in stage presentations, radio plays and playlets are making even more sweeping changes in props. As you close your eyes and listen to radio dramatic productions, little do you dream that an entire staff has been planning and working for days to make the props complete even to the minutest detail. An error or miscalculation in it would be more easily detected than on the stage and might mar the entire performance.

WHEN KFAE went on the air for the first time two years ago last December, from the electrical engineering laboratories of the State College of Washington at Pullman, it was through the vigorous work of President E. O. Holland who was instrumental in securing financial appropriations. But it was through Hubert Vinton Carpenter, dean of the College of Mechanical Arts and Engineering that college sentiment was roused to the pitch where the students and alumni demanded a station.

Most of the people in the outlying districts in Washington and Idaho couldn't get long distance reception for most of their sets were crystal sets, and so they thought some of their tax money ought to come back in the form of a broadcast station. And it did.

Dean Carpenter graduated from the University of Illinois with specializing in electrical engineering for his undergraduate work and in mathematics and physics for the post graduate studies. He has been a member of the state college faculty since 1901 and Dean for the past eight years. He has contributed articles to various technical periodicals along his particular field and, at last, his ideas have become crystallized in the establishment of the state college station which is a pioneer in the field of state colleges.

KFAE uses a 330-meter wave length, but the new assignment will change this to 535. During the college year this 500-watt station broadcasts Monday, Wednesday and Friday nights from 7:30 to 9. Some lectures are, of course, given by faculty members, but a good deal of the entertainment is furnished by the music faculty of the state college.

THE first 1,000 watt-er in the Pacific Northwest is now on the air in Seattle with the call letters of KFQX owned by the American Radio Telephone Company with studio located in the mammoth L. C. Smith office building on the twenty-first floor.

A remote control line operates to the Hotel Butler orchestra which broadcasts twice each night. The new station observes Sunday and Thursday as silent nights and the daily programs are practically continuous from 6:45 until 11:00 o'clock.

From the studio, high above the busy mart of trade and commerce, commanding views of the surrounding country greet the eye of the artist amidst the artistic furnishings of a commodious studio that has been pronounced by radio technicians as practically acoustically perfect.

The famous Zoellner Quartette broadcasts frequently from KNX

One of the popular features of the programs is the bedtime story by Aunt Vivien. Instead of a motherly old soul of mature years, Aunt Vivien is a pretty, vivacious Miss in the early twenties. Miss Vivien Potter, program arranger and announcer, doubles also as Aunt Vivien and her quaint animal stories for the youngsters have met with popular favor.

Earl Gray and his orchestra, playing in the Rose Bowl of the Hotel Butler, have received telegrams from every state in the union since they began to broadcast early in December.

Alfred M. Hubbard, Seattle electrical wizard, who operates the station and who owns fifty per cent. of the American Radio Telephone Company stock, is authority for the statement that application is to be made for a 1,500 watt license early this year.

KNX made its initial bow to the radio public late last year in Los Angeles and brought the total number of 500-watt stations in that city to four as well as the 1,000 KFI station.

Known as "the voice of Hollywood" the new station of the *Los Angeles Express* has been selected for a series of tests extending through a period of six months by the city school board and, Tuesday mornings, children in all primary schools have a lecture via radio from KNX.

The opening night program was put on the air by Milton Sills, veteran stage and screen actor, and Charlie Wellman, a prince of jazz, acted as announcer.

The station comes on the air daily at eight o'clock with the morning prayer and the "Town Crier" brings forth news items every hour until six in the evening when a musical program is broadcast until midnight.

One control line is now in operation to the Ambassador Hotel with the famous Cocoanut Grove and the Concert Orchestras. Afternoon musicales were broadcast by this station during the December radio show via remote control.

The mechanical equipment and studio is in the Paul G. Hoffman-Studebaker Building in the heart of Hollywood, with its vast wealth of screen talent, and already a number of fine community programs have been sent out from KNX.

Mrs. Carrie Preston Rittmeister, former hostess of KHJ, is the program arranger at Southern California's newest station, which operates most of its programs on a toll basis and presents its entertainment through the courtesy of commercial and industrial firms of the Southland.

THE Naval Radio Station NPX, in Inglewood, just outside of Los Angeles, has been sold by the Federal Government to the National Electric School. This station, long considered one of the most powerful sending stations on the Pacific Coast, has not been in operation for a number of months.

The new equipment is being moved to the School headquarters at Figueroa and Santa Barbara Streets, Los Angeles, where classes are held to coach for government license examinations and for training in every phase of technical, commercial and broadcast radio.

JOHN STONE STONE

A mathematical physicist whose work on the mathematics of tuned radio circuits made possible the practical radio results of today

By Oscar C. Roos, B.S., M.E., Fellow I.R.E.

MANY names are blazoned on the radio honor roll today and yet very few of those interested in this rapidly spreading art know of the epoch making work which this remarkable mathematical physicist did nearly a generation ago in a field too difficult for any but the most highly gifted to explore. His work on the mathematics of tuned radio circuits, especially with regard to the different kinds of couplings, condenser coupling, resistance coupling and inductance coupling, was the means of leading engineers along a path which permitted the remarkable results we are now getting today in tuning—years after the laws governing these effects were laid down.

It is therefore somewhat of a late hour for laymen and recent radio experts to talk about radio being in its infancy. As a matter of fact, it is no more in its infancy than the automobile industry and it is only within the last three years that a great deal of the early research work done by Stone has been put to practical use by others. If a general estimate were to be made of what this pioneer has done, it might be said that he has shown the way in which to apply the principles governing carrier wave telephony and most of our modern filter-circuits so as to permit multiplex

(*Turn to page* 82)

The Children's Hour

A Sunday morning program that is an inspiration to young and old, presented regularly from WJZ by prodigies

By Golda M. Goldman

Constance Campbell, who has appeared with Broadway stars in benefit performances

"Between the dark and the daylight

When the night is beginning to lower,

Comes a pause in the day's occupation

That is known as the children's hour."

THAT enterprising studio WJZ has transferred this sacred period from the evening to nine o'clock of a Sunday morning when daddy and mother may turn over for the best sleep of the week while the kiddies tune in for their own special entertainment.

If Longfellow with his love for children could stray into the midst of this very modern children's hour what joy he would find. Whole bevies of bright-faced, happy youngsters throng the rooms on the sixth floor of the Aeolian Building in New York City. There are little black velvet frocks with parti-colored ribbons, little pink crépe de chine frocks with blue ribbons, little yellow frocks with ruffles, little boys in white silk blouses or trimly clad in belted suits, this one a musician, that one a poet, another a dancer. What a feast of youth and beauty it would be for the beloved New England poet and how the children would indeed storm "The Round Tower" of his heart.

The presiding genius of the morning is Mr. J. V. Smith of "The New York American." Perhaps it is because Mr. Smith is a bachelor that he is so well able to appreciate and manage the children with whom he comes in contact. Certainly he loves them, as his work with "The Christmas Fund of the New York American" shows, and surely the children love him, from Baby Betty Sargent who wants to be fondling him constantly, to Omar La Gant, the boy poet.

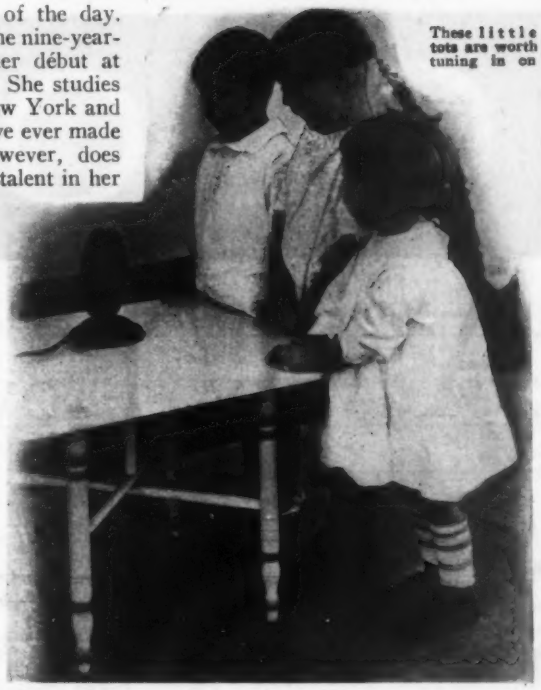
There are so many talented children from whom the studio can choose that it is an impossibility for them to put on a program which is not remarkable in its variety and value. Of course, the most popular is Sylvia Froos, who likes to be called "Baby Sylvia," although she is growing so tall that she will soon be able to talk into the microphone without standing on a chair. The fact that she has a most remarkable voice is attested to by the fact that she draws five hundred a week on the Keith Circuit and is known all over the country for her syncopation. She appeared at the Eddie Cantor dinner where she followed the great comedian and caused almost an equal sensation. Sylvia never took a singing lesson in her life. When she and her mother are traveling about the coun-

Boy and girl entertainers in the WLS Woodshed Theater Play

try a private teacher goes with them and when she returns to New York she goes back to school where at present she is attending P. S. 64 in the Bronx and is in Class 5B. Sylvia is a born mimic and can put more pep into a five-minute performance than most entertainers can put into an hour. In a black velvet frock embroidered in colors and black patent-leather Cossack boots with gray tops and socks she is a perfect little star as she faces the microphone which presents no terror for her.

Another favorite is Omar La Gant who is the typical artist with long, blond, wavy hair, white silk blouse and black knee-breeches. Omar, who will probably be an actor one day, is at present an elocutionist who has won many contests. For instance, he has a gold medal presented by "The Southland Singers," a body of professional entertainers which meets at the Plaza Hotel. The medal was a token of his work on their monthly programs. Another gold medal comes from the "Metropolitan Theater League," and was won in open contest at the Waldorf-Astoria in the drive to form a Junior Auxiliary. Last October he won a silver loving cup offered by the Detenu Social Club in Lenox Assembly Hall in a best entertainer's contest. Omar has been taught by Mr. J. G. Geiger and Miss Isabell Mersin, of the School of the Theater. He has appeared in the excellent fairy tale performances which were given last year on Saturday afternoons by the School of the Theater, such as "Pinkie and the Fairy." His excellent diction and unusual interpretations have won him notices in many of the dramatic journals of the day.

Little Anna Diamond, the nine-year-old pianist, is to make her début at Aeolian Hall this winter. She studies under Boris Feibish of New York and is his youngest pupil to have ever made a solo début. Anna, however, does not possess all the musical talent in her family as her brother who is seven years old, plays the violin so well that they will appear together at a concert at the Academy of Music in Brooklyn in February. Anna's unusual talent may be judged by the fact that her concert program includes the "Hungarian Phantasy" by Liszt, the "Four Impromptus" by Schubert, "Lasches" by Paganini-Liszt, and the "Concert Stuck" by Weber.



These little tots are worth tuning in on

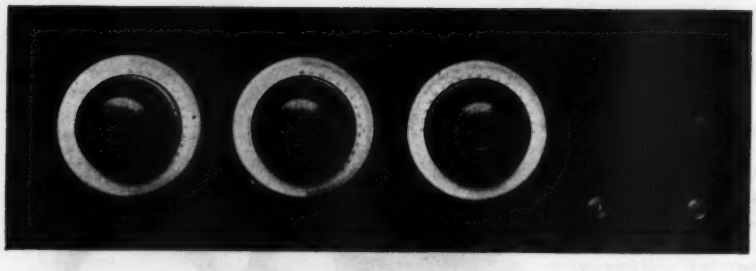
It is unfortunate that dancing cannot be transmitted via radio for then Gertrude Chevallier, the ward of Madame Chevallier, the dancing mistress, would be able to do her Russian and Acrobatic Dancing for her young audience. As it is, however, she recites comics for them instead. She may be seen frequently at Hunts Point Palace and will soon appear in vaudeville on the Keith Circuit.

You would love to see little Henrietta Luhrs, a seven-year-old vision in fluffy pink, as she stands on a chair to sing "Barefoot Days" into the microphone. Henrietta is probably an old friend of yours from the movies for she has appeared with Tommy Meighan and many other stars. For instance: She was in "West of the Water Tower" with Glenn Hunter and May McAvoy, in "The Snow Bride" with Alice Brady, and in "Zaza" with Gloria Swanson. Henrietta is also a student of Madame Chevallier and her forte is Oriental dancing and high acrobatic kicks which she can do with a perfection seldom found in a young child.

Perhaps the most unusual entertain-

(*Turn to page* 75)

Little Sylvia Froos and her sister Mildred entertaining some notables—Jas. Swinnerton, Winsor McCay and Uncle WIP of Philadelphia—while broadcasting their program from WJZ



REDUCTION of losses in receiving apparatus marks the most recent development in radio—learn what it's all about by building this set

HOW TO BUILD A Very Low-Loss Receiver

By R. A. Bradley

WHEREVER you go or wherever you are, at the present time, you hear "low loss" this and "low loss" that. What does it mean anyway when you get down to hard facts? Is this another fad sweeping the fans like a new circuit or is it a real development?

It most certainly is a development—a marked and notable one. And one needs only to make comparisons between a real low loss receiver and standard "hiloss" sets of a year ago, to be convinced. When you look back over the receiver you used a few years ago you cannot help but wonder how the poor little micro-volt of signal energy ever reached your headphones.

The reduction of losses in receiving apparatus marks one of the outstanding developments in radio in the past ten years.

What does the reduction of losses accomplish? It sharpens tuning; it increases signal strength; reduces set and tube noises; and in these ways the reduction of losses means a more efficient receiver.

LIST OF MATERIALS

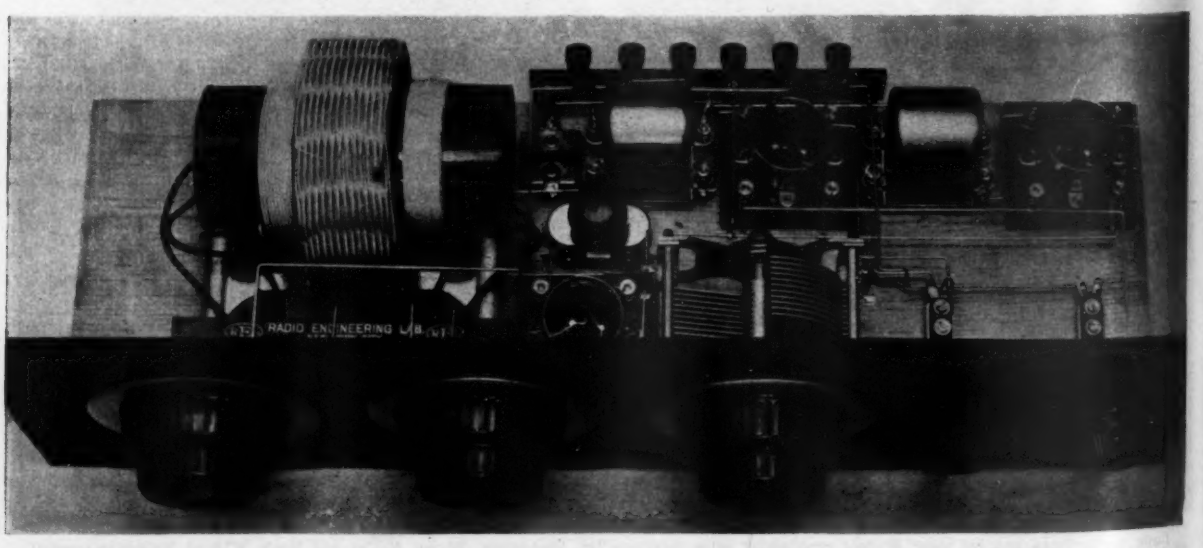
One Low Loss tuner (Radio Engineering Laboratories)
One .0005 mfd. variable condenser (General Instrument Co.)
Three Standard sockets (Howard)
Two Audio transformers (Pacent)
Two Single closed circuit filament lighting jacks (Pacent)
Two Bradleystats
Three Micro-Dials (Jewett)
One 7x21 Panel (Pyradiolin)
Six Eby Binding Posts
One .002 mfd. fixed condenser (Dubilier)
One Bradleyleak and .00025 mfd. Condenser

The receiver about to be described has been used for only a month, yet in that time it has certainly proved what low loss design, construction, and assembly will accomplish in a receiver.

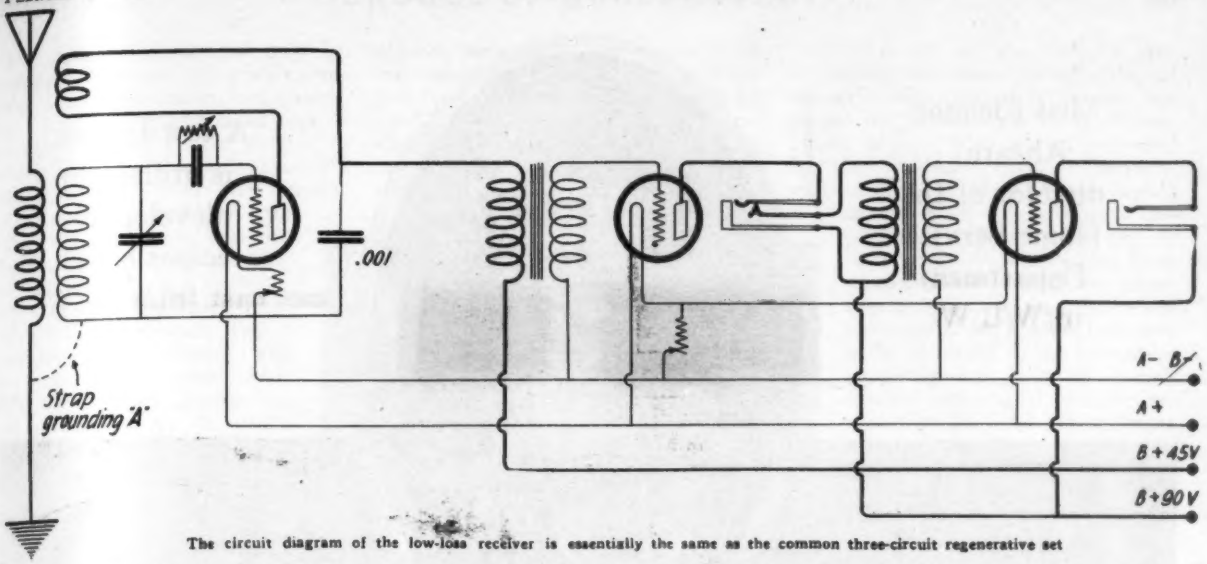
The main tuning unit is manufactured complete and includes a basket weave fixed secondary, a tickler coil and a primary coil. The latter two are wound solenoid fashion on bakelite tubes. Perhaps you wonder why low loss design is not carried into effect in these instances. Why?—because there is absolutely no advantage to be had from the reduction of resistance in the plate circuit of a regenerative detector tube. Did you know that the average fan's antenna has comparatively very high resistance and that the removal of one ohm from the primary coil will have no effect on the operation of the set? Such is the actual truth of the matter.

The variable condenser tuning the secondary further carries out the low loss practice. It is a grounded rotor condenser of superior construction insulated with Isolantite which needs no introduction.

The sockets are those which have excellent side-wiping contacts with real honest-to-goodness springs in them. When you put the tube in the socket—you know it's hitting "on all four" contacts.



By placing the detector tube socket as shown between the tuner and the variable condenser, the shortest possible leads are secured. The Bradleyleak together with the grid condenser connected directly across its terminals is placed directly behind the detector tube socket



The circuit diagram of the low-loss receiver is essentially the same as the common three-circuit regenerative set

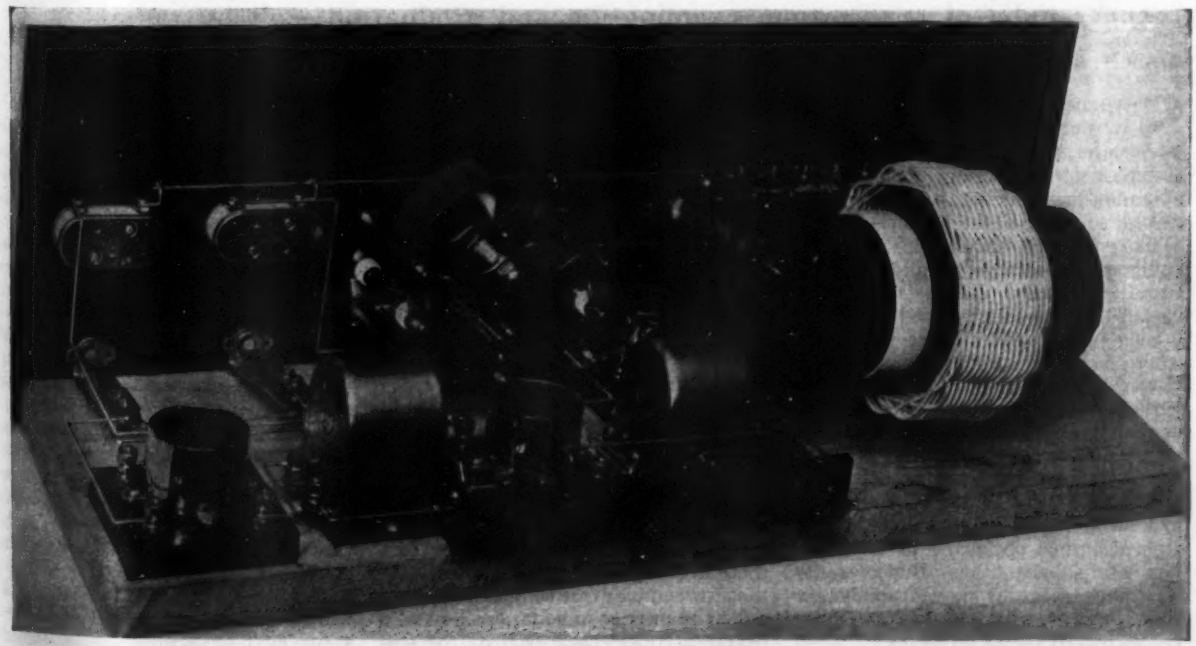
You see now what we meant by low loss in construction and assembly when it is carried even to contact springs on sockets, and the results speak volumes and these results are more convincing than ever printed words could be.

How to Build It

The main consideration in the first stages of the receiver's construction is the panel layout. You must have a 7" x 21" panel and on this panel must go three tuning dials, two rheostats and two jacks. The best arrangement is as follows: The hole for the shaft of the primary coil is drilled 3½" from the left end of the panel and centered, up and down. The template furnished with the tuner will indicate the proper drillings for the tickler shaft and supporting screws. The distance between shaft centers is given on the template. Measure off an equal distance to the right of the tickler shaft and center punch this for the shaft of the tuning condenser.

When this is accomplished the position of the rheostats will be simple to locate. The two jacks are placed in a line 1¾" from the base of the panel. This completes the panel layout. Attention is next directed to the baseboard and to the instruments mounted thereon. Particular attention was paid to the layout of the transformers and sockets for most efficient operation, shortest leads and simplest connections. By placing the detector tube socket between the low loss coil and the variable condenser it is possible to secure very short leads. The audio frequency unit is then laid out along the rear edge of the baseboard in as compact a manner as possible. We wish to call your attention particularly to the method of making connections to these excellent audio frequency transformers. The leads are brought out in such a way that it permits mounting the transformers slightly to the rear of the sockets, and the plate and grid connections come out directly to the tube socket binding posts. The B plus and A minus are to the rear of the transformer and go directly to their respective binding posts. This is the ideal method of making transformer con-

(*Turn to page 73*)



The relative positions of all instruments is clearly shown in this illustration. The long piece of bus-bar running along the panel is the common negative return lead

Miss Eleanor Ahearn, director of the Home Service Department of W L W

A test kitchen is utilized to develop all recipes broadcast from WLW

Radio Schools of Housewifery

Well defined study courses in home subjects, with all the paraphernalia of registration, examination and graduation—all by radio!

By Mrs. Christine Frederick

So much attention is focused on music, political talks, etc., by radio that perhaps the biggest and most significant single development of radio broadcasting is being overlooked. I refer to the broadcasting of cooking and household information, and home education via radio throughout the country. This development has, in the past year, reached quite surprising proportions. Three years ago, when I wrote an article in "Good Housekeeping" advocating greater attention to this subject—then almost neglected—I felt I was voicing a hope rather than an expectation. I believed very strongly that radio could do a great deal to lift American housewifery to new levels of enlightenment, but it seemed rather optimistic to hope for big results very soon. But in radio all things seem to move rapidly; in tune perhaps with the 186,000 miles per second of the radio waves!

At any rate, 1924 has been a remarkable year for variety of education and service, on cooking and household and other topics rendered to women by radio broadcasting stations. It is all the more remarkable for the reason that such service has been established permanently, which indicates certainty of future growth to splendid proportions.

A few years ago there was very little service to women. One or two stations had little ten-minute talks to housewives; and the stations which sold advertising time had occasional paid talks on miscellaneous food and household subjects. Today, there are at least 50 large sized broadcasting stations in the country which have a more or less regular service of more than usual competence and scope. This number is increasing almost every week. In fact there are large sized broadcasting stations owned by great companies having a definite interest in better cookery who devote a considerable part of the station to the task of home education. Even this is not all. There are now universities and other institutions offering well defined study courses in home subjects, with all the paraphernalia of registration certificates, examination papers and certificates of graduation—all by radio!

I have thus sketched in brief what has been going on, and while estimates of listeners-in in the radio field are likely to suffer from "Wallingfordian" exaggeration, I feel it safe to say that at least 1,000,000 women, if not 2,000,000 women are listeners-in on home economics information and help.

I can do no better in picturing the situation than to describe some of the actual work of stations along these lines, and leave you to judge of its value as well as to infer the equally valuable work done by other stations not mentioned.

It will be impossible to describe the work of all stations; and I select from a survey I have made on the subject some of the more unique and interesting examples.

The stations I name, not only include stations operated by private companies, but by universities, newspapers, etc. I have tried to give some idea of the varied nature of the service to women and also to select examples from sections all over the country.

Perhaps we may well start with examples of university facilities offered to women over the radio, since this is, no doubt, a more important development than others. I have known, for years, that a great number of women who have children and even those whose children are grown up, have yearned to go to school again, and wished for educational advantages denied them in earlier years. But the great response which cooking and home making courses via radio have met with has surprised everybody.

Let us start with the always unique state of Kansas, whose State Agricultural College at Manhattan, Kansas, Station WTG, 273 meters, has a well planned course in home economics, requiring the applicant to sign an enrollment card which definitely makes her a part of the student body. Dr. Margaret Justin lectures every Thursday evening, and if you suppose that only Kansas women are enrolled, you will have a pleasant surprise, for a dozen or more states are represented in the enrollment. Women as far away as Canada are interested, and the teachers have a heavy mail. A certificate is granted those who pass the course satisfactorily and you may be assured that no fancy sheepskin from a great university is more highly prized than this certificate.

It may be supposed from the foregoing that only women in Western University states are interested — but you are wrong again! Possibly the most zestful and active of the courses of home education, the one which has been operating longest, is that operated by the Peoples Light & Gas Company of Chicago. When I organized this company's "Home Economics Department" several years ago, thousands of women came personally to the daily lecture rooms, and being a radio fan, I realized that radio would certainly be a means of further extending such service, especially to women who could not leave their homes. Mrs. Anna Peterson's talks and lessons on cooking over the radio in Chicago are now classics and are listened to by many thousands of women. This course requires an enrollment and offers a certificate on completion of the course. The Gas Company furnishes nicely printed blank books for recording the recipes broadcast as they come over the radio, and thus brings into existence a totally new kind of cook book "compiled out of the air" to you.

Gilson V. Willets, operator and technician at WOC

Nº 1100
STATION WOC
This Certifies
THAT
has been granted membership in the
HAPPY HOMES CLUB
OF RADIOPHONE STATION WOC
having qualified for Membership by studying the Lessons of interest
which was broadcast
Honorary Member
1924
THE PALMER SCHOOL OF CHIROPRACTIC
DAVENPORT, IOWA
"WHERE THE WEST BEGINS AND IN THE STATE WHERE THE TALL CORN GROWS."

Membership certificate of the Happy Homes Club awarded by station WOC

Possibly the most thoroughgoing of all such radio courses is the one operated by station WCCO at Minneapolis, Minn. This station is owned by the Washburn-Crosby Company, makers of Gold Medal Flour, and it is easy to see why such great emphasis is placed on service to housewives. It is one of the facts of modern advertising that whatever increases the intelligence and alertness of the housewife is sure to be of benefit to the companies supplying her; and the broad-minded educational attitude assumed by the Gold Medal people is naturally a most valuable public service. Miss Betty Crocker lectures to women over the radio each morning at 10:45. On Mondays and Tuesdays it's a cooking lesson; on Wednesday, Home Management; on Thursday, meal planning; on Friday, practical nutrition, and on Saturday, talks to girls. In this way the full range of home knowledge is gone over. A direct connection making the service practical from a business point of view is operated by sending to those who inquire and ask for them, printed recipe cards to be used in the card recipe file. A cooking course running eight weeks is broadcast each Tuesday night, constituting a complete line of study for which certificates are issued. This station aims to achieve the reputation of being most definitely for women's practical benefit, and operates a service probably unequaled throughout the country for scope and variety of women's material. There is a further women's hour every afternoon at 2, used for a great variety of home topics—beauty talks —dance lessons, music, cultural topics, women's club work, business and politics.

Another station which is already widely known nationally—the Radiophone station WOC, 484 meters—the Palmer School of Chiropractic, of Davenport, operates also a rather unique service. A regular feature which is increasing in popularity is the Happy Homes Club which specializes on a daily morning talk of home helps. Instead of dully broadcasting a lecture, the schedule calls for *a meeting of the Club*, and thus gives it something

of a social aspect. The service to the home is made concrete and vivid by the publication of an elaborate booklet of "helpful hints for happy homes" which contains 64 pages of recipes, together with a description of the service of the station and blank pages for the insertion of broadcast recipes. WOC when first starting the home service work secured the co-operation of the home economics department of the United States Department of Agriculture, which especially prepared a daily bulletin for broadcasting. The most popular plan operated by this station, however, was to ask housewives to submit their recipes and household hints so that they might be broadcast. Particlar interest was developed by setting aside each week for definite types of dishes. This brought a great mass of recipes. An additional success was developed during the Spring and Summer season by a daily garden talk. The WOC Club is in the hands of Mr. Wilson Willets, who nearly two years ago organized the first women's service from this station and understands the need for and the response to material of this sort. There are talks on Interior Decoration, Cooking, House-cleaning, Travelogues, Dress-making, Fashion, Children's Games, Poetry and many other items. The unique feature of this Happy Homes Club is that it is run by its members. Membership is granted as soon as they send in a recipe, or give other indication of definite interest. A certificate of such membership is shown on page 37.

During the Christmas holidays, prizes were given for the first and second best complete menus submitted by listeners-in, thus giving the stimulus of competition to the station.

Sears, Roebuck & Company, operate station WLS, 345 meters, in Chicago, and with its usual advertising genius has made a great deal of this service. It has in charge of its Home Maker's Hours, Margaret Reese Filkins, and instructive talks are broadcast by executives of the Illinois League of Women Voters, the Federation of Women's Organizations, as well as others who are utilized. Each day household material is broadcast, the subjects covering a broad range of material including, for instance, a talk by Elizabeth Weirich on clothing and textiles for the home woman. At Christmas time a big hit was made by broadcasting a special Christmas menu by a famous Chicago chef, M. Henri, Chef of College Inn at the Hotel Sherman. This menu is reproduced herewith for its special interest.

Rosemary Cramb, announcer at WGY, in charge of programs for women

CHRISTMAS MENU

M. Henri, Chef; College Inn
Hotel Sherman, Chicago

Fruit Cocktail

Celery—Olives—Salted Almonds

Chicken Broth in Cup
Saltine Wafers

Roast Turkey Stuffed with Oysters
Green Peas in Cream
Candied Sweet Potatoes
Cranberry Sauce

Head Lettuce French Dressing

English Plum Pudding
Hard and Brandy Sauce

Assorted Nuts

Coffee

Another station which is utilizing the special interest of a large well-known concern is the Crosley Radio Station WLW, 423 meters, at Cincinnati, which broadcasts a home service department in charge of Miss Eleanor Ahearn, who is Director of Household Research with the Procter & Gamble Company. A cooking school is broadcast from this station, and is another example of happy combination of private and public interest.

New York has been rather slow to develop broadcasting of such material, but WJZ, 455 meters, The Radio Corporation of America's New York station, has a women's hour of real value and interest each morning. WEAF, 492 meters, the A. T. & T. New York station, has started a very extensive home study course backed by the kindergarten of Teacher's College, Columbia University. The subject upon which they will concentrate this winter is *child training*. The lectures are delivered actually at Columbia University and operated through "remote control" system, relaying to the WEAF studio. The lectures will even include part of the University Chapel service, to give mothers taking these courses the further sensation of going to college. The subjects listed for this quite important course cover a wide range — "How Mothers May Keep in Touch with Children's Interests;" "How Mothers Can Help Children to read;" "Games Children Love to Play;" "Children's Nature Interests;" "Children's Religious Problems;" "Songs for Children;" "How to Tell Biological Facts to Children;" "Choosing Books for Children;" "How Children Can Make Christmas Gifts and Playthings;" and "Worth While Toys and Playthings for Children."

The lectures of the series are to be 20 minutes long, which is less than

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Among the Broadcasters

By Ed Randall

"Hook" Kennedy, Scotch comedian and singer, who has toured the country several times and has won the unqualified approval of WRC fans

In Defense!

By Carl Dreher

AMONG the cruel and unusual hardships to which broadcast operators are subject, is the fact that they can never get married. Working at night, they are unable to take their best girls to the movies, which embitters these charming maidens and alienates their affections in a short time. When a technical broadcaster does marry, it is by dumb luck or misrepresentation. Furthermore, owing to the excessive wisdom of the broadcast operator, it is impossible for a woman to live with him once such an ill-starred marriage has taken place. Remember, my friends, that a broadcast operator has listened to thousands of informing talks on cheese brokerage, the boll weevil, why girls should stay at home, what to feed the children when they bawl into the airshaft at 3 A. M., how to get to Flatbush, and countless other significant topics. His head whirls and swells with all this intelligence, and consequently he becomes unbearable. Whenever his wife speaks to him, he catches up her first phrase and releases a torrent of exposition on the single tax or mumps. She has no chance to get a word in edgewise, and, as we all know, nothing could be more galling to a woman. The result is, in this case, that she resorts to force, but the broadcaster-husband, having absorbed numerous talks on boxing and ju-jitsu, knocks her through a window. A few such incidents are enough to end any marriage.

Joseph Knecht, the modest but brilliant director of the Waldorf-Astoria Concert Orchestra, "just loves" to speak to "Mike"

But here we contemplate a striking instance of poetic justice in real life. The affliction suffered by the broadcast operator's wife whose case we have just analyzed, is a daily occurrence in the life of the unfortunate operator himself. For eight hours each day he suffers under the impact of

Graham McNamee, reading—not "speaking" this time—a rare occasion for this busy and well liked announcer

songs, sermons, bedtime stories, political arguments, ukulele solos, and all manner of sounds of man and beast, without the slightest chance to pour out his own soul—and he has one—in any of these ways. The listener may tune to what he pleases or shut off everything with a flip of the switch, but the operator must stay at his post—or go back to the soda fountain. His own urge for self-expression is constantly smothered under the multiplied similar urges of other people. Some day, it is to be feared, the technical staff of a broadcasting station will rise in armed rebellion, seize the equipment, and run amuck on the air until shock troops can be dispatched to put down the revolution and return the station to the forces of sanity and order. While the operators hold the fortress, what a caterwauling and bedlam will din into the ears of the amazed listeners! All the technical experts will try to talk and entertain at once, and none will stay behind to monitor the apparatus, which, sizzling and on the point of melting, will add its own quota of discord to the horrible medley. Then in deed, the broadcast critics will have something to write about!

"The Radio Franks"—Wright and Bessinger—just tickle themselves, the piano and everybody

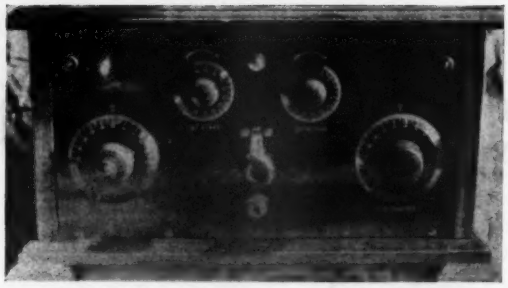
And now we must consider the special injury the broadcast operator suffers when he transmits from a theater. Picture a susceptible young man, seated at his amplifier in the wings, in the act of broadcasting a musical comedy. He is surrounded by ravishing chorus girls in costume, who flutter around him, when they are not on the stage, and simply throttle him with their admiration and attentions. They all want to listen to the output of the amplifier, and I have seen such a crush of dazzling females around the operator at a theatrical event that he thought

(*Turn to page* 70)

Arthur Murray, well known dance instructor, broadcasting one of his latest—the "Radio Glide"

Chas. Wold, perhaps, has perverted the proper use of drinking glasses, but his broadcast audiences become intoxicated just the same whenever it is his treat

One of the simplest and best of the regenerative receivers



A set that affords a most consistent type of performance

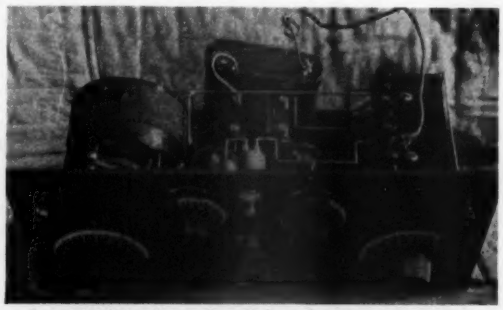
Modifying the Reinartz

By W. P. Lukens

THERE are some circuits known to practically everyone who has combined wire, metal plates and insulation to form a receiving set. These circuits are based on the "Old Reliable," known variously as the "Armstrong," the "Short Wave Regenerative," "Two Variometer and Variocoupler," etc., and the "Reinartz." These circuits are comparatively simple and all of them will work when everything else seems intent on failing. The Armstrong has probably been the most modified and experimented with because it is the most easily understood. In the Reinartz form it is usually associated with the mysterious-appearing spider-web coil, and while many different forms and types of this winding have been produced, it remains essentially the same as regards ratio and number of turns. I have seen the "Reinartz Coil" wound with everything from No. 18 enameled wire to No. 28 d.s.c., on everything from an air core to bakelite discs and wooden spokes.

The main difficulty with modifying the Reinartz is that as soon as it is perceptibly modified it no longer stays a Reinartz. However, for a short period there appeared a form of the Reinartz which used a specially wound variocoupler instead of the special coil. This modification was as good in action as the regular circuit and offered no advantages in the way of either construction or operation. More recently there has appeared another modification of the circuit which is at least as good in operation as the original and is very much easier to construct. Its tuning is as simple as that of the "Ultra-audion" and in addition it will do a few things in the way of reception which are strongly reminiscent of radio-frequency amplification rather than of regeneration. However, I am not so sure that this modified circuit is still a Reinartz, which may account for some of its peculiarities.

To show the development of this circuit, it may be well to examine the regular Reinartz, in the form in which it is usually drawn, as shown in figure 1. The complication of the three sets of taps is clearly indicated; but if the diagram is re-drawn, as shown in figure 2, it is much easier to understand what it is all about. Here it is clear that an aerial circuit is tuned by means of taps, and that a secondary circuit is tuned both by means of taps and a condenser. The regenerative action is apparently a species of tuned conductive feedback, controlled by both taps and condenser. Many people never get to understand the function of the different condensers and taps and for that reason never realize the full effectiveness of their sets. It is probably also that in many cases poorly constructed switches decrease the effectiveness of the set, through setting up losses of poor contact.



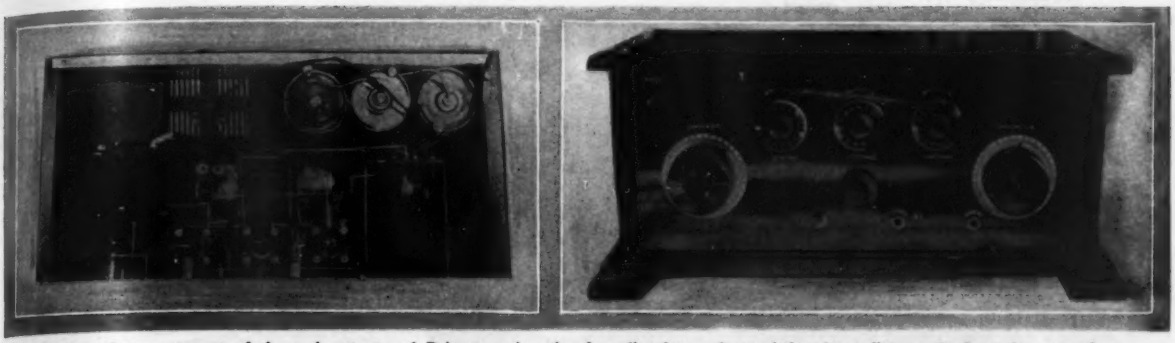
A most compact panel and base board arrangement is afforded by following Mr. Lukens' design

The author's two-tube variometer-tuned plate Reinartz receiver showing a rear view

The first step toward modification of the circuit consists in changing the method of controlling regeneration. Instead of a tuned feed-back, a tuned plate circuit is used, accomplished by eliminating the regenerative coil and condenser and inserting a variometer, exactly as the plate circuit is tuned in the Armstrong. This change naturally very largely changes the type of tuning inductance, and while the spider-web coil may still be used, there is no reason why a simpler tube-wound coil may not be used. Keeping this fact in mind the next transition is to do away with all the remaining taps through the simple process of designing the tuned and untuned coils so as to cover the existing broadcast range. Figure 3 shows the use of tap-tuned coils as compared with the use of fixed coils shown in figure 4.

The circuit of figure 4 is the one which has been used in making up a considerable number of sets, but if one is inclined to build a set which is even a bit simpler and appears slightly better mechanically, the circuit shown in figure 5 is the next step. This presents, of course, merely another method of tuning the plate circuit, using a coil and condenser instead of the variometer. I believe that two of the usual "neutrodyne" transformers and condensers could be used quite satisfactorily, though this has not been tested, and it is possible that some modification of the coils might be required before the best arrangement is determined.

The circuit shown in figure 5 naturally suggests the addition of another tube to result in a tuned-impedance radio frequency set, but there is no real reason for following out this sug-



A three-tube arrangement of the variometer-tuned Reinartz using the dry-cell tubes and permitting long distance loud speaker reception

gestion, as it would only result in a circuit which would make two tubes do the work of one.

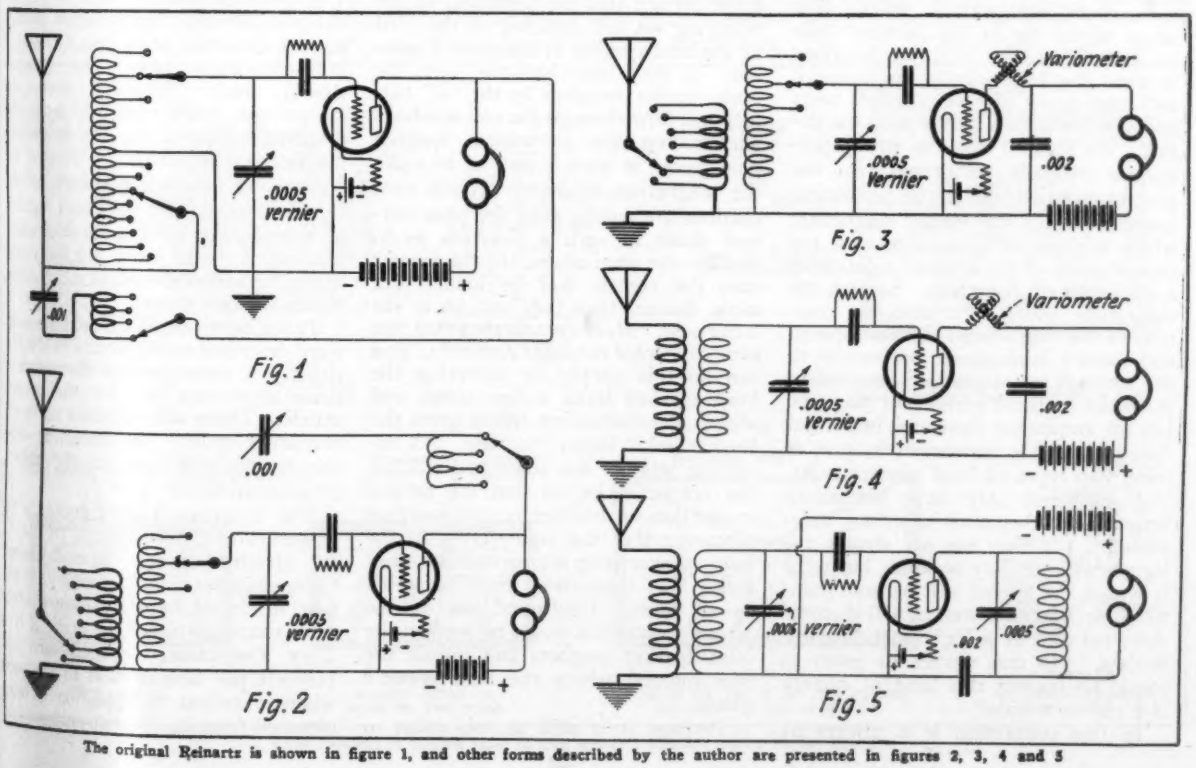
Going back to figure 4, it will be seen that the only part of the circuit requiring any explanation is the tuning inductance. This is made up of a single tube-wound coil, consisting of fifty turns of number 22 d.s.c. wire, wound on a 4 inch bakelite tube. A tap is taken off at the seventh turn, this tap being the common ground point of the two coils. Thus the antenna connection is to one end of the coil; then the tap at the seventh turn goes to the ground; and the other end of the coil goes through the grid condenser and leak to the grid of the tube.

The result is a set on which all of the tuning is done on one 23-plate vernier condenser while the regeneration is perfectly controlled by a variometer. In this perfection of control is found some of the most striking characteristics of the set, for the condenser readings will be almost identically the same for a given wavelength, regardless of the length of the aerial. Even when an aerial is used without any ground, or when the ground—attached to the aerial post—is used without any aerial, the readings will be practically the same as if both aerial and ground are used. Similarly a change in the variometer setting has practically no affect on the tuning, so that a station may be tuned in with a minimum of regeneration, then the signal strength increased to a point just under oscillation.

It is this quality of control over regeneration which permits sharp tuning, for when operating at a point just under oscillation, station interference is unusual. When very close to a powerful station it is sometimes necessary to operate with the aerial only, since this sharpens up the tuning remarkably without any very noticeable decrease in strength. Thus with one of these sets located less than a mile from the Edgewater Beach station in Chicago, it is possible to tune it out and bring in either WDAP—ten meters difference—or WLS—25 meters difference—without any interference, using the aerial only. The set is so sensitive that very good reception is obtained on short inside aerials or on a bed spring, or even on the ground alone. On the ground only, Kansas City, Pittsburgh, and Providence have been received on one stage of amplification, in Chicago.

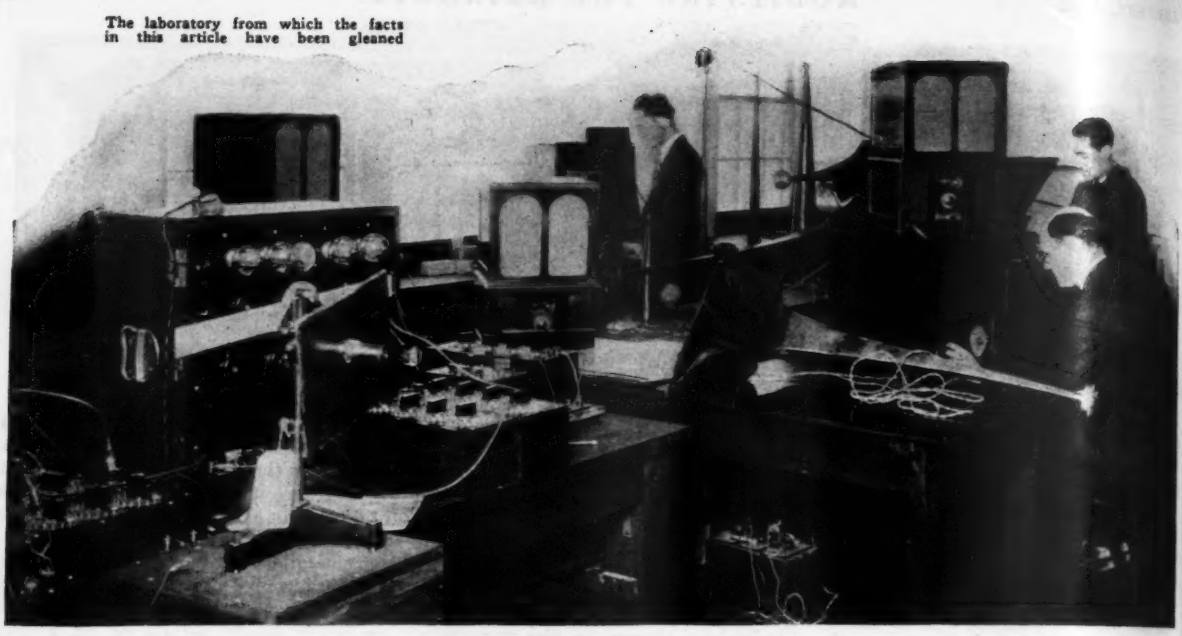
The volume is as satisfactory as the sensitivity, and all local stations loudspeak satisfactorily on one stage of amplification. On one stage only, using a good aerial and ground, both Pittsburgh and Kansas City have been brought in on the loud speaker. With two stages of amplification the loud-

(*Turn to page* 71)



The original Reinartz is shown in figure 1, and other forms described by the author are presented in figures 2, 3, 4 and 5

The laboratory from which the facts in this article have been gleaned



Loud Speakers
AND RADIO RECEPTION

The induction type, the moving coil type and the moving strip type of loud speaker discussed

By John P. Minton, Ph.D.

THIS is the second article of the series on "Loud Speakers and Radio Reception." In our first paper appearing in the January issue of THE WIRELESS AGE, we described in some detail the bipolar and balanced armature types of loud speaker units and discussed their action in some detail. We showed that the strong permanent magnets performed two important functions: first, the permanent magnets supply the steady magnetism which is required to make possible the reproduction of the original signal with a minimum of distortion. Second, the magnitude, which determines the loudness of the reproduced signals (speech and music) is in direct proportion to the strength or amount of magnetism produced by these permanent magnets. Let me emphasize these two important functions of the permanent magnet in these two types of loud speaker units. We must not only have permanent magnets, but they must be strong, magnetically. If they are not strong, the signals will not only be weak, but what is worse, the speech will become unintelligible and the music will become distorted and of a high pitch "raspy" quality. No one wishes to listen to music possessing this kind of quality if it can be avoided.

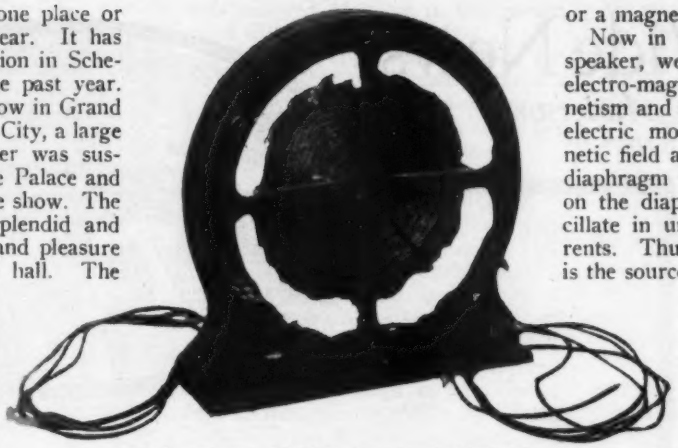
In this connection it is always of considerable importance with loud speaker units of the bipolar type to make certain that the terminals of the receiving set are attached to the cord of the loud speaker in the correct manner. If the connections are right, the plate current supplied by the "B" battery will flow through the coil windings surrounding the permanent magnet pole pieces in such a way as to make the magnetism stronger. If the connections are wrong, then the plate current flows in such a direction as to weaken the magnetism. In the former case the signals will be louder and more distinct than they will be in the latter case. *Make certain then that you have connected the leads correctly.* You can do this simply by reversing the loud speaker leads a few times and choose the connection which gives the louder and "cleaner" signals. All receiving sets are not connected alike at the output jacks, so that the correct connection on one set is no assurance whatever that the connections to the loud speaker plug are correct for other sets. The connection must be tested in all cases. Continued use of the wrong connection is apt to weaken the loud speaker magnets and impair the reproduction which the loud speaker gives.

Perhaps it is well at this point to correct a slight error which crept into one of the sentences in our last paper. The sentence occurs about two-thirds along in the paper immediately preceding the equation $(10+2)\times(10+2)=100+20\times2+4=144$. The sentence should read: "Suppose, then, the amount of magnetism acting on the diaphragm caused by the permanent magnet is represented by 10 and the amount of magnetism caused by the signal current from the radio receiver is represented by 2 additional units. The word "pull" used originally was apt to be misconstrued to mean force, which was not meant.

Three other types of loud speakers were described rather briefly in the first paper. A more detailed discussion of these types was left for the present article. These will be taken up in the following order: the induction type, the moving coil type and the moving strip type.

The Induction Loud Speaker is the invention and development of Dr. C. W. Hewlett of the General Electric Company's research laboratory. It was first described by the inventor about three years ago under the title, "A New Tone Generator." Since then Dr. Hewlett has developed it to the point where excellent reproduction is being obtained from it. Perhaps many of my

readers have heard it in one place or another during the last year. It has been on public demonstration in Schenectady, N. Y., during the past year. During the recent radio show in Grand Central Palace, New York City, a large model of this loud speaker was suspended in the center of the Palace and was in operation during the show. The speech and music were splendid and could be heard with ease and pleasure in any part of the large hall. The speaker here referred to is of large dimensions, perhaps three feet in diameter and weighs perhaps 100 pounds or so. It requires a substantial "power plant" to operate it and is not intended for ordinary use such as required for the home.



A new type of loud speaker recently developed

A photograph of a small size model of this type of loud speaker is shown with the present paper. It is about 12 inches in diameter and weighs a few pounds. A sketch of it is shown in figure 1. The operation of this type of loud speaker is different than the bipolar and balanced armature types discussed previously. A direct current from a 110-volt power supply passes through the plane ("pancake"), circularly wound, coils as indicated in the sketch. The current flows in opposite directions through these coils, so that a magnetic field is set up between the coils in such a way as to flow out radially from the center as shown in the sketch. A light aluminum diaphragm is clamped between the two coils. The signal current flows through the coils in such a way as to cause electric currents to flow circularly in this diaphragm. These currents are induced by the alternating magnetic field passing through the diaphragm set up by the signal current and, hence the name, induction loud speaker. The signal currents, of course, oscillate and cause the circular currents in the diaphragm to flow around in one direction and then in the opposite direction, thus oscillating in unison or in synchronism with these signal currents.

Now in all electro-magnetic phenomena, we have electricity, magnetism and motion. In the electric generator we have magnetism and motion and these two give us the electricity in motion, or current. In an electric motor we have magnetism and current and these give us motion. And an electric charge on a moving wire gives us moving electricity and therefore magnetism or a magnetic field suspended in space.

Now in the induction type of loud speaker, we utilize the second of the electro-magnetic phenomena; viz, magnetism and electric current; that is, the electric motor principle. The magnetic field and circular currents in the diaphragm set up a mechanical force on the diaphragm and cause it to oscillate in unison with the signal currents. Thus, the vibrating diaphragm is the source of sound waves of speech and music, just as in other types of loud speakers, but the type of force causing these vibrations is of the ordinary electric motor type and not the magnetic type as used in the bipolar and balanced armature types of units. Just as we need a strong permanent magnet for the two latter types of units, so we need a strong direct current to supply a strong magnetic field for the induction type of loud speaker in order to produce loud and undistorted signals. The action and results in the two cases are identical.

The sound comes off from the diaphragm itself in this type of loud speaker. This diaphragm is large and sets up vibration in a large volume of air. Thus no horn is required for this type of loud speaker. If its diaphragm were small, then a horn would be required. Let us now pass on to the consideration of the moving coil type of loud speaker unit.

The force actions of this type are similar to the induction type described above. An illustrative sketch of this

(*Turn to page* 68)

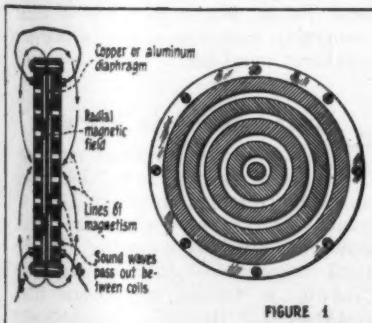


FIGURE 1
INDUCTION TYPE OF LOUDSPEAKER

Diaphragm radial magnetic field and circular currents produced by signals

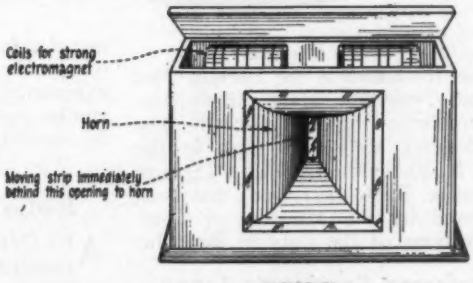


FIGURE 5b
GERMAN LOUDSPEAKER OF METAL STRIP TYPE SHOWN AS MOUNTED IN CABINET WITH BUILT IN HORN

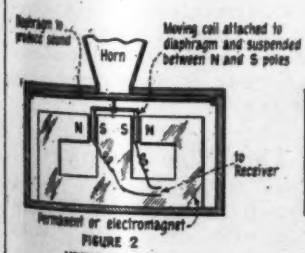


FIGURE 2
MOVING COIL TYPE OF UNIT

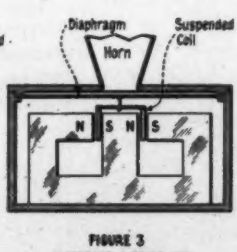


FIGURE 3
INCORRECT METHOD FOR MOVING COIL TYPE OF UNIT

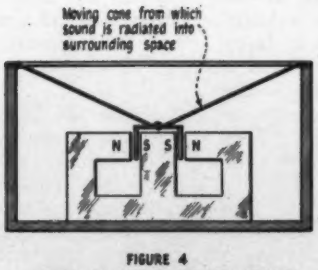


FIGURE 4
MOVING COIL TYPE OF UNIT WITH ATTACHED CONE INSTEAD OF HORN AS IN FIG. 2.

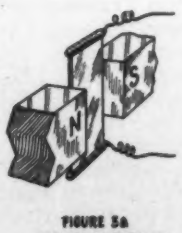


FIGURE 5a
GERMAN LOUDSPEAKER OF METAL STRIP TYPE

Some elements in various types of loud speakers that are treated by Dr. Minton

World Wide News

By C. S. Anderson
Managing Editor of Wireless Age

Station at Riga—Deferred Service to Japan—Lithuanian Station—Government Buys 80 K.W. Tube—German Patents in Demand—Wave Lengths Shifted

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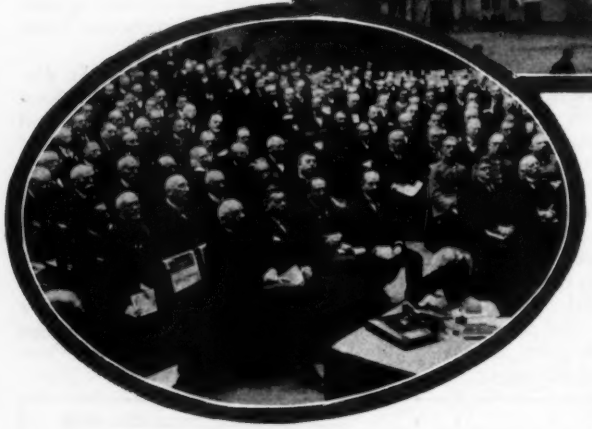
The Radio Research Hall in Germany recently completed and views of the first exposition held, with the prominent German officials who were present at the opening



Station at Riga

THE resolution of the Latvian Post and Telegraph Main Administration to entrust the erection of the new broadcasting station at Riga to the French Radio-Electric Co. (Societe Française Radio-electrique) has been approved by the Minister of Communications of the Latvian Republic.

Deferred Service to Japan

EFFECTIVE January 1st, 1925, deferred radiogram service at half the full, ordinary rate is available via San Francisco and RCA to Japan, Angaur, Chosen (Korea), Formosa, Jalouit, Japanese Saghalien, Kwang Tsung, Palaos, Pescadore Islands, Ponape, Saipan, Tsing Tau, Truk, Yap and Japanese offices on the South Manchurian Railway, south of but not including Harbin.

This deferred service is available between the above places and the United States, Canada, the West Indies and Central and South America but not from Europe.

Lithuanian Station Considered

IT IS informally reported that the Lithuanian Government will erect a new radio station on Mount Vitovt, near Kovno. The State has apparently dispatched a technichal expert to France for the purpose of purchasing radio apparatus and equipment. It is contemplated that a similar station may later be constructed in one of the provinces.

Radio Telephone in Bahia

ALTHOUGH all radio communication throughout Brazil is under the exclusive control of the Federal Government, permission was recently requested by Senor Juan Moreno Del Valle to install a radio service in Bahia and developments are pending. A radio society has already been formed in Bahia with 100 members who have paid the 50 milreis entrance fee and are paying monthly dues of five milreis. The National Telegraph Service and the Polytechnic Institute have promised encouragement and assistance. There is already in this city a small Seimens-Schukert apparatus which will be demonstrated before a class in the Polytechnic Institute some time in the near future.

It is said that several cities and towns in the interior have made inquiries regarding radio equipment. Considering the great extent of Bahia and the difficulty and slowness of all means of communication, a broadcasting service from this city which could reach all or most parts of the state would be extremely useful. There is a wireless telegraph station of the Telefunken system already in operation near Bahia, but it is under Federal ownership and is used exclusively for maritime purposes.

Broadcasting in Norway

THE number of registered radio amateurs in Norway is still increasing and now amounts to about 2,400, of which 900 are in Christiania. It is, however, officially estimated that the total number of radio amateurs in Norway is around 10,000 and from 6,000—8,000 paying subscribers can therefore be expected when broadcasting begins.

The Western Electric Norsk Aktieselskap, the company which has been granted the concession for broadcasting in Norway, is proceeding rapidly with its plans.

The Milan Station

THE Italian government has granted a concession of radio broadcasting to a group of companies, one of which is the Western Electric Italiana. A new broadcasting station at Milan will be of Western Electric construction.

Station at Zurich

A NEW broadcasting station at Zurich, Switzerland, was put into service recently. The Bell Telephone Manufacturing Company of Antwerp, which is associated with the International Western Electric Company, supplied the equipment.

Government Buys 80 K. W. Tube

THE Bureau of Engineering of the United States Navy Department has awarded a contract to the General Electric Company for the manufacture of an 80 kilowatt or 80,000 watt electron tube transmitter. This powerful radio-telegraph transmitting device will, when completed, be installed either at the naval high power station at San Diego or Mare Island.

It is understood that the General Electric Company is constructing three of these 80,000 watt transmitting tubes. This really means "superpower."

German Patents in Demand

THE Navy Department is being flooded with requests from American radio manufacturers for the use of the German radio patents recently offered on reciprocal licenses. A standard non-exclusive, non-transferable but revocable license has been drawn up and will soon be submitted to applicants with a request for a list of their patents which would become available to the government. The process of going over the many applications and accompanying lists of patents will require considerable time. All applications will not be granted; probably only those firms having patents believed of value to the government will be cross licensed.

Fifty-three applications already listed indicate that considerable interest is manifested in the Schloemilch-von Bronk reflex hookup, which is the best known of the German patents.

Wave Lengths Shifted

REALLOCATION of wave lengths for broadcasting stations throughout the United States is being made in an effort to eliminate "squeals."

WNYC, municipal broadcasting station, has been ordered to take a wave length of 528.8 metres and approximately 567 kilocycles to avoid interference with Station WOAW, Omaha, Neb. KDKA is broadcasting experimentally on 316 metres, shared by Stations WGBS and WAHG, and at 309 metres WSAI is trying 326 metres. WWJ, Detroit, is expected to receive a new wave length.

Radio and the Public

By HERBERT HOOVER

THE greatest development in broadcasting up to the present has not been in the application of new methods of transmission or reception, important as improvements in these lines have been. It is rather in the change in public attitude. Listeners are becoming more and more appreciative of the real service of radio and increasingly critical both as to the character of the matter furnished them and as to the efficiency with which it reaches them. The whole broadcasting structure is built up on service to the listeners. They are beginning to realize their importance, to assert their interest and to voice their wishes. Broadcasting must be conducted to meet their demands and this necessarily means higher character in what is transmitted and better quality in its reproduction to the ears of the listener. The broadcasters as a whole are alive to the situation. There is a growing realization on their part of the public responsibilities they assume in conducting an agency so greatly affecting the cultural progress of our people. The innovations of which we hear so much—national programs, wire interconnection, short wave rebroadcasting, increased power, and wired radio, which are already playing so important a part and are destined to have still greater influence for good—are based entirely upon the necessity for meeting the growing popular requirement of better service. The demand will continue to increase, and new methods of efficiency will continue to be found to meet it. But beyond all radio has begun to enrich American life by a real contribution to the home. It yet has far greater service to perform in this way and I believe this year will see great and more definite advance in this direction.

Bureau of Standards Scientific Paper No. 469

PART of the information contained in the article entitled "The Beam System," by K. M. MacIlvain, appearing in the December WIRELESS AGE was obtained from the Bureau of Standards Scientific Paper No. 469 entitled "Directive Radio Transmission on a Wave Length of Ten Meters," by F. W. Dunmore and F. H. Engel. Mention of this fact was omitted in the article mentioned and Mr. MacIlvain desires to have that omission corrected.

The Swedish high power station at Grimeton, near Göteborg

What's the Trouble?

Here are a few pointers that may save you time and worry

By Robert Alan

WHEN you are just about convinced that your receiving set is the best little static collector in the world and that you have collected all the static that there is to be collected it is about time to look over your set. Static of course is responsible for most of the noises that come through your set which is not defined as music or clear speech. But you can't blame static for everything any more than you can honestly blame "those blasted amateurs" when some ship operator decides that it is necessary for him to use two kilowatts of a broad spark to work WNY upon entering the harbor. A shorted condenser or one in which the plates touch in their rotary motion will produce very annoying clicks and explosions and frying noises and you may be laying the blame on static when it is nothing more nor less than a condenser which has served its purpose in this world and is ready to be junked. Good variable condensers don't suffer from misalignment of the plates nor shorting. But we all haven't got the best condensers. One way, and probably the best way, for determining whether your condenser is shorted or whether the plates touch in their circular movement is shown in the accompanying illustration. Take a spare B battery, a voltmeter, and the variable condenser in question and connect them in series as shown. If any reading is obtained on the voltmeter whatsoever the condenser is shorted. In performing this operation rotate slowly the rotary plates throughout the entire 360 degrees several times and make sure that there is no short circuit. This is not harmful to your B battery so you need not be skeptical as to its advisability. The same test can be tried with your audio frequency transformers. Many sets go dead because of a blown primary winding. This is not entirely avoidable except that care should be exercised in connecting or disconnecting the B battery lead on the transformer when the filaments are turned on. This sometimes causes voltage surges requiring the very fine wire to carry greater current for an instant than it is designed to carry resulting in a punctured winding. In order to definitely tell whether the transformer is blown or not, disconnect it and remove it from the set and put it through the same test as your variable condenser. The result of the test in this case will be exactly the opposite as it was in the case of the condenser. You should get a reading on the voltmeter if the winding is intact. Of course it will not be the full 22 volts of the B battery or whatever your supply happens to be, because of the resistance of the winding. The use of a pair of phones instead of a voltmeter is not so accurate because unless the ear is trained to an open circuited click in the phones, there will be a click heard whether the winding is O. K. or open-circuited.

By means of a screw driver, bend up the socket contacts to make good contact with the tube

Tighten up the back screws on binding posts before putting the instrument into the set

If your tubes have a peculiar way of going out and coming back again as you turn up the filament rheostat you can be very sure that the contact arm of your rheostat is not on speaking terms with the resistive winding. In most rheostats this can be remedied by removing the knob and contact arm and bending the latter so that it brings more pressure to bear on the winding. While you are doing this get the screw driver into action and tighten up the binding post screws on the terminals of the rheostat. This will mean that you won't have to do it the next time. Please note the illustration in which the socket prongs are being bent up by a screwdriver. This is great stuff providing you take the socket out of your set before you do it, but don't under any circumstances get a screwdriver near the socket with batteries and tubes connected as you can cause considerable damage if you do.

Before the sockets are installed in the set see that the prongs are making proper contact, put the tube in the socket, try the tension of the springs. This should make good stiff contact. After your set has been in operation for six months or so it will be well to remove the tubes from the sockets, disconnect the batteries and go after them with a screwdriver. A side wiping contact such as in the Howard Socket, General Radio, Radio Corporation, The Caldwell and others need no such treat-

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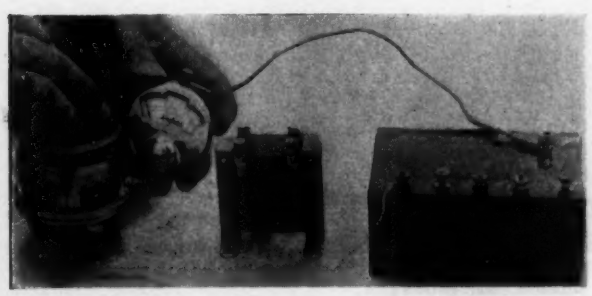

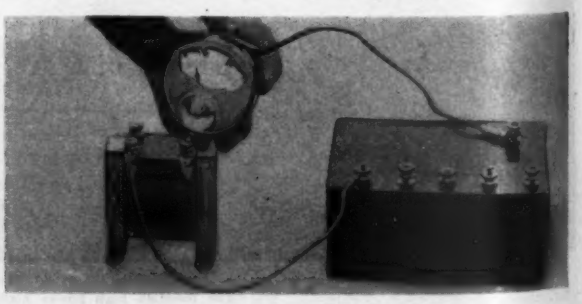

Testing variable condensers and transformers before mounting them in the finished set will often eliminate the task of removing faulty apparatus

Radio Apartments

Plug into any one of several programs without tuning or trouble of operation

By Elizabeth Ives

This is all there's to it—plug in and enjoy the program

TO hear famous speeches, music, songs, stories, it is merely necessary for the 354 apartment owners of "Hudson View Gardens" to push a plug into the wall. It's as easy as turning on the electric light switch! There is no dialing, no tuning in. With this one motion the program of any broadcasting station is theirs.

I could hardly believe it. In fact all my Missouri ancestors rose up in me and asked "to be shown" as Mr. Smith told me of this new wizardry—the just invented multiple radio system that offers a choice of programs, the only one in existence. He led me into one of the 354 apartments. There in the sitting room on a table was a small loud-speaker with a cord attached. And near the floor was a small square face-plate having four holes in it. It looked very much like an electric light wall outlet. "Make yourself comfortable and try it," said Mr. Smith. I sank into an easy upholstered chair near the table, stretched out my hand for the plug at the end of the cord, pushed it into one of the four holes, and instantly we were listening to Walter Damrosch's Symphony Concert.

And any broadcasting station was at my command. King Canute commanding the waves to retire never felt half as powerful as I at that moment. Nevertheless I was merely one of 354 pluggers. The power behind the plugger is Harold L. Kerr.

We found him sitting up in a little box-like room on the roof among his gigantic apparatus, worth about $35,000. The walls of the little room are covered with it; a big shelf and table filled with it and only room enough is left for one wooden chair on which Kerr sits and tunes, and dials, and listens far into every night.

Kerr is the radio engineer and the control operator. Up in this room he can receive and transmit four programs simultaneously to one or to 354 apartments! Here on one shelf stands, within two feet of each other, four up-to-date receivers with loop antennas—a sight to astound even the most expert of radio fans!

Kerr keeps himself continuously connected with three local broadcast-

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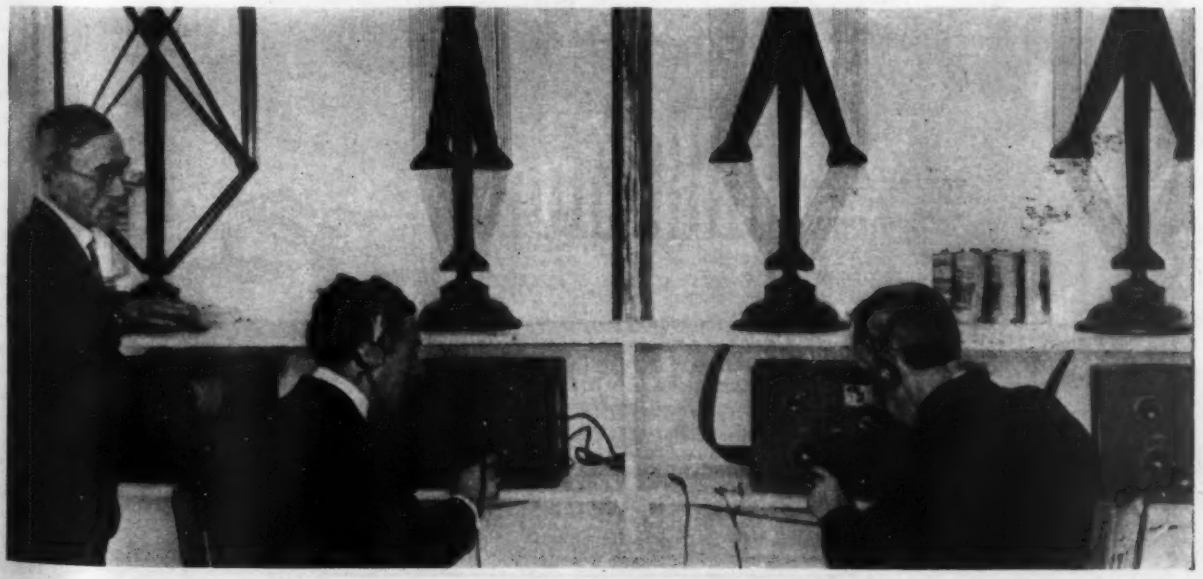


Four loop receivers are used to tune in the broadcast programs selected for the families in the radio apartment house

PRODUCTION of ELECTRIC CURRENT

How the Dry-cell and Storage Battery Operates—Construction and Care—High Voltage Radio Batteries

By Samuel C. Miller

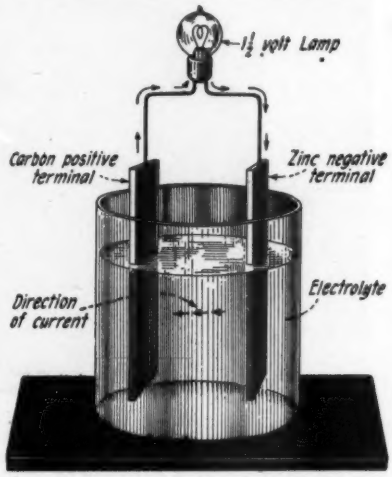
Member Institute of Radio Engineers

THE batteries play an important part in radio today because practically every receiving set employs them in one form or another. Without the batteries the receiver is like an automobile without gasoline, the prime factor in making the machine run. If the broadcast listener is interested in the principles of radio, it is very essential for him to know how a current is generated within a dry cell or utilized in a storage battery. This is one of the fundamentals in electricity and should be mastered not only because of the knowledge obtained, but also because a better understanding is gained in the care of these units. A knowledge of the operation and care required of storage batteries would be especially helpful to those who use them, as they are often given a great deal of abuse.

This article discusses thoroughly the various types of batteries in use and also partly covers the generation of an electric current by a mechanical device.

Analogy of An Electric Current

The production of a steady electric current is more easily seen if the method of obtaining a steady flow of water in a building is taken as an analogy. To produce a steady flow of water in a pipe, there must be available a hydraulic pressure, or, as it is technically called, a "head" of water. To obtain this head, the water is first pumped into the tank provided on the roof of the building from the water main in the street until a height is reached in the tank which will give the steady pressure of water required for use throughout the building.



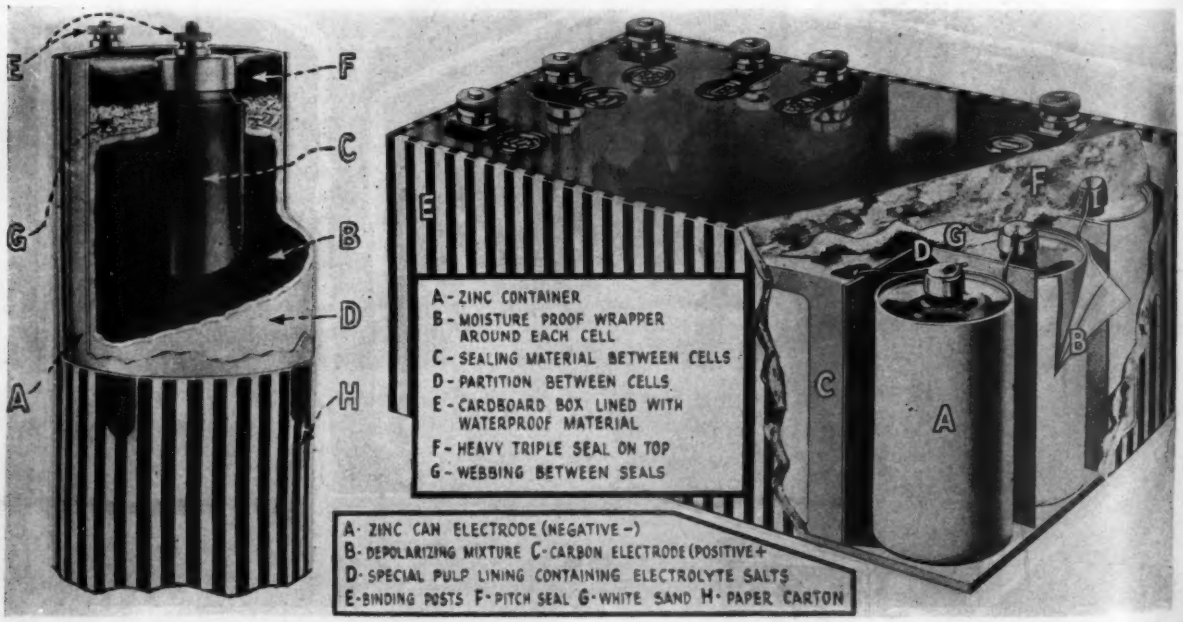
An electrolytic cell or set battery similar to the type used in land line telegraphy

A similar condition is required for the production of a steady electric current. There must be available a steadily maintained electric pressure known under different aspects as "electromotive force," "potential difference" or "voltage" which has the force to cause a current to flow. This produces energy of an electrical form that has the facility of performing work of various natures. Electrical energy is used to give us light and heat and to drive machinery; it allows us to communicate by means of the telephone, telegraph or radio. It is one of the most powerful agencies the human race has at its disposal today, and without a doubt the progress of civilization can be attributed in part to the day that Volta gave the world the simple cell which provided a source of voltage for producing an electric current.

The necessary electromotive force or voltage required to cause the electric current to flow may be obtained in either one of two ways: chemically or mechanically.

Source of Voltage from a Chemical Device

Very early in the investigations leading to our present day knowledge of electrical phenomena, Volta dis-


A - ZINC CONTAINER
B - MOISTURE PROOF WRAPPER AROUND EACH CELL
C - SEALING MATERIAL BETWEEN CELLS
D - PARTITION BETWEEN CELLS
E - CARDBOARD BOX LINED WITH WATERPROOF MATERIAL
F - HEAVY TRIPLE SEAL ON TOP
G - WEBBING BETWEEN SEALS
A - ZINC CAN ELECTRODE (NEGATIVE -)
B - DEPOLARIZING MIXTURE C - CARBON ELECTRODE (POSITIVE +
D - SPECIAL PULP LINING CONTAINING ELECTROLYTE SALTS
E - BINDING POSTS F - PITCH SEAL G - WHITE SAND H - PAPER CARTON

The inner workings of the two most important batteries of a radio receiver. The dry-cell and the dry B battery. The cut away portions of the illustration show how these much used sources of energy are assembled and the elements incorporated

covered that all metals have a relationship to each other, and if one metal such as zinc is brought into contact with another metal such as iron, an electric current will flow. This phenomenon can be readily demonstrated by any one. One of the simplest experiments is to take a copper penny and a silver dime and lay between the two a moistened piece of paper. If the two terminals of a pair of phones are placed one on the dime and the other on the penny, a click will be produced in the phones. This indicates that, in the circuit consisting of the penny, the moisture, the phones and the dime, a current has flowed which was caused by a voltage or electromotive force being produced by the contact of the two dissimilar metals.

A scale for the different metals has been worked out, showing which metals are most positive and which are least positive. The following list is so arranged that the metal first on the list becomes positively electrified when touched by any taking rank after it:

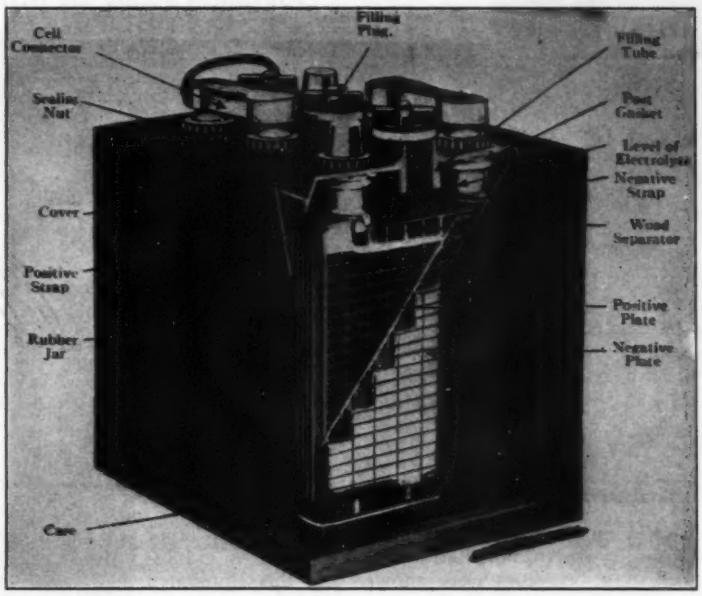
+zinc
lead
tin
iron
copper
silver
gold
—graphite.

For example zince is more positive than iron, but iron when used with graphite becomes the positive element. In the experiment given above the copper penny is more positive than the silver dime.

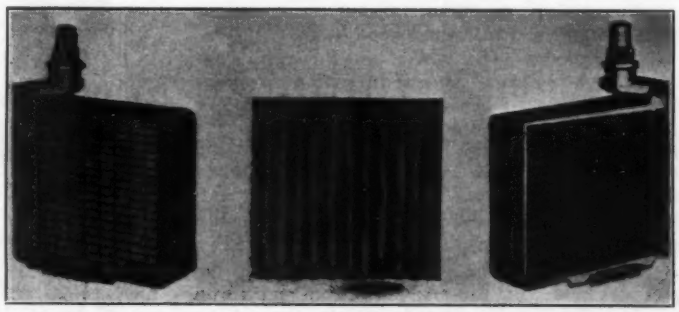
Going still further, Volta found that certain liquids acted in a similar manner when brought into contact with metals. He found that by virtue of the chemical action between the liquid and the metals, a source of voltage could be produced that will cause a current to flow when the unit is connected to an outside source. He therefore had a device that converted the chemical action between the liquid and metals into electrical energy.

THE VOLTAIC CELL

When two dissimilar metals as carbon and zinc are immersed in an electrolyte of sal-ammoniac dissolved in water, the chemical action on the zinc will cause an electrical current to flow in the closed path formed externally between the carbon and the zinc. This is shown in figure 1 where a simple voltaic cell is connected to a lamp. The chemical action in the electrolyte causes the current to flow from the zinc to the carbon within the solution and from the carbon to the zinc, through the lamp in the outside circuit. Because the current leaves the carbon, it is called the *positive* terminal and the zinc becomes the *negative* terminal because the current enters it on passing through the lamp.



A radio storage cell showing a cross-section view exposing the internal elements of an individual cell and its surrounding casing



The positive and negative plates and the separator used to keep the individual cells from short-circuiting. To each set of positive and negative plates a connector post is burned or soldered

The metals are termed elements and the liquid is the eletrolyte. The combination of the elements, electrolyte and the containing vessel constitutes a voltaic cell.

When two or more cells are placed in a container so as to form a single unit, this unit is termed a battery. The word battery is frequently used incorrectly to designate a single cell.

CLASSES OF BATTERIES

Batteries are divided into two classes, primary and secondary. Cells are said to be primary if they generate a current within themselves and secondary if they first require a charge from an external source of energy before they become operative.

The primary type is illustrated by the dry cell in common use, where a relatively large current is supplied momentarily or a very small current is required for a long period of time. Every one is acquainted with the dry cell as used for ringing a bell or lighting a bulb in a flashlight and those who have radio sets with WD-11 or UV-199 vacuum tubes require dry cells for lighting the filaments. When the dry cell has lost its electrical energy then a new one must be bought for replacement as the old one becomes useless and is discarded.

However, when a battery is desired that will give a relatively high current or high power for a length of time, then the secondary type of battery is available. The secondary type or storage battery is suited for automobile starting and lighting, the driving of small motor apparatus and in radio, principally for supplying a steady flow of current to the filaments of six-volt vacuum tubes of the UV-201A type. It is very important that the current supplied to the filament of a vacuum tube be very constant as any change in the source of voltage will interfere in the proper operation of the receiving set. A storage battery fulfils this condition admirably as it will deliver a steady current of considerable power for a relatively long length of time; the length of time depending on the capacity and condition of the battery.

DRY CELL

The dry cell in common use today consists of a zinc plate made to act as a container and also as the negative pole, and a carbon positive plate in the form of a rod in the center of the container. The container is first lined with a bibulous paper moistened with electrolyte and then filled with a depolarizing mixture made up of pul-

(*Turn to page* 64)

Los Angeles Exposition

A radio show that beat Horse-shows, Dog-shows and all other shows

Miss Louise Klos, talented harp soloist, tapping — no, tuning in one of the best sets at the show

(Left)—Vi Dodd's Syncopators furnished the music for all the happy dancers

(Below)—Louise Glaum, scenarist, who presented a one-act skit

THE second annual radio exposition held in Los Angeles by the American Radio Exposition Company of New York was the center of attraction for six days commencing December sixth in the auditorium of the Ambassador Hotel.

The Public Address System brought the exposition programs to the audience, while both KNX and KFI broadcast programs from the stage by the *Los Angeles Express* and *Los Angeles Examiner*. The programs brought considerable interest because of the fact that famous actors of the stage and screen acted as master of ceremonies including Monte Blue, Larry Semon, Lew Cody and others.

The radio industry banquet was held in the Fiesta Room of the hotel during the exposition with an immense representation of well known people in radio activities including representatives of the broadcast stations, Colonel J. F. Dillon, Federal supervisor for the sixth district, and members of the following organizations: Radio Jobbers' Association, Radio Manufacturers' Association, Radio Retail Division of the Music Trades Association of Southern California and the Credit Bureau of the Radio Jobbers' Association.

The exposition was operated on a co-operative basis with the radio organizations of Southern California and most of the features of the first show that did not meet with popular favor were eliminated. No demonstrations of loud speakers, amplifiers or other sound producing apparatus by exhibitors were allowed and this eliminated one of the objections of a year ago. Likewise the floor space for exhibits and visitors was practically doubled and there was not the crowding as at the original exposition.

Many well known radio characters were present in various booths—those of broadcast stations and also of commercial concerns. Some of those included Uncle Remus, otherwise known as E. M. Bonnell; The Sandman and Queen Titania, of KHJ; Madelyn Hardy, the radio girl, and Louise Sullivan, singing violinist, of KFI; as well as the announcers and studio directors of Los Angeles who met throngs of radio friends afternoons and evenings at the auditorium.

While the Los Angeles exhibit held its full quota of the unusual in radio—of miniature sets, and the like—it was particularly noticeable that there was far greater interest than usual on the part of the public in the more expensive sets. The sets which are well known for distance getting and the sets with cabinets in period designs drew large crowds.

Interest did not lag in the display and demonstration of parts and the cheaper sets, but Los Angeles is rapidly becoming the Mecca for de luxe receiving sets. In Hollywood, for instance, movie stars are ordering quaint designed cabinets and sets for their palatial homes—designed to match the period furniture or perhaps so wired that each guest room will have a concealed loud speaker for entertainment.

In the 108 booths arranged around the sides of the Ambassador Auditorium every conceivable kind of firm was represented. Many radio publications had representatives as well as all the large radio manufacturers in addition to the local concerns and branch offices.

With the end of the second show there can be little doubt but that the experimental stage is past and this is now to be a permanent annual event in the Pacific Southwest. This year's event attracted in proportion a greater number of the general public than any other event of similar character. Horse shows, dog shows, and all kinds and varieties of exhibits, attract a certain percentage of people, but a radio show brings together about everyone in the community.

BROADCASTING STATION DIRECTORY

The Most Authentic, Up-to-the-Minute List of Stations Broadcasting in the United States, Canada, Cuba and other countries.

KDKA Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa. 326
KDPM Westinghouse Electric & Mfg. Co., Cleveland, O. 270
KDPT Southern Electrical Co., San Diego, Cal. 244
KDYL Newhouse Hotel Salt Lake City, Utah 360
KDYM Savoy Theatre San Diego, Cal. 280
KDYQ Oregon Institute of Technology, Portland, Ore. 360
KDYL Frank E. Siefert Bakersfield, Cal. 240
KDZB Rhodes Department Store Seattle, Wash. 270
KDZE Bellingham Publishing Co. Bellingham, Wash. 261
KDZR MacArthur Bros. Mercantile Co., Phoenix, Ariz. 360
KFAD State College of Washington Pullman, Wash. 330
KFAE Western Radio Corporation Denver, Colo. 278
KFAJ University of Colorado Boulder, Colo. 360
KFAM The Electric Shop Moscow, Idaho 360
KFAR Studio Lighting Service Co. (O. K. Olsen), Hollywood, Cal. 280
KFAU Independent School District of Boise City, Boise High School, Boise, Idaho 270
KFAW The Radio Den Santa Ana, Cal. 360
KFAY Virgin's Radio Service Medford, Ore. 283
KFBB W. A. Buttrey & Co. Havre, Mont. 360
KFBC W. K. Azbill San Diego, Cal. 278
KFBE Reuben H. Horn San Luis Obispo, Cal. 242
KFBG First Presbyterian Church Tacoma, Wash. 360
KFBK Kimball-Upson Co. Sacramento, Cal. 283
KFBL Lonse Bros. Everett, Wash. 224
KFBO Trinidad Gas & Electric Supply Co., and Chronicle News, Trinidad, Colo. 265
KFBU The Cathedral Laramie, Wyo. 263
KFCB Nielsen Radio Supply Co. Phoenix, Ariz. 338
KFCF Frank A. Moore Walla Walla, Wash. 360
KFCL Leslie E. Rice, Los Angeles Union Stock Yards, Los Angeles, Cal. 336
KFCP Ralph W. Flygare Ogden, Utah 360
KFCV Fred Mahaffey, Jr. Houston, Texas 360
KFCY Western Union College Le Mars, Iowa 252
KFDY Omaha Central High School Omaha, Neb. 258
KFDZ St. Michael's Cathedral Boise, Idaho 252
KFDM University of Arizona Tucson, Ariz. 268
KFDJ Oregon Agricultural College Corvallis, Ore. 360
KFDL Knight-Campbell Music Co. Denver, Colo. 226
KFDM Magnolia Petroleum Co. Beaumont, Texas 305
KFDX First Baptist Church Shreveport, La. 360
KFDY South Dakota State College Brookings, S. D. 230
KFEB Harry O. Iverson Minneapolis, Minn. 231
KFEC Meier & Frank Co. Portland, Ore. 248
KFEL Wimer Radio Corp. Denver, Colo. 254
KFEQ Seregin & Co. Bank, Oak, Neb. 268
KFER Auto Electric Service Co. Fort Dodge, Iowa 231
KFEX Augsburg Seminary Minneapolis, Minn. 261
KFEY Dunbar Hill & Sullivan Mining and Concentrating Co., Kellogg, Idaho 360
KFFB Jenkins Furniture Co. Boise, Idaho 240
KFFE Western Oregon Radio Co. Pendleton, Ore. 360
KFFF First Baptist Church Moberly, Mo. 266
KFFR Nevada State Normal Sparks, Nev. 226
KFFV Groveland College Lamoni, Ia. 280
KFFY Louisiana College for Women Baton Rouge, La. 275
KFGC Louisiana State University Baton Rouge, La. 254
KFGD Oklahoma College for Women Chickasha, Okla. 252
KFGH Leland Stanford University Stanford Univ., Cal. 273
KFGL Snell and Tivy Arlington, Ore. 234
KFGQ Crary Hardware Co. Boone, Iowa 226
KFGX First Presbyterian Church Orange, Texas 256
KFGZ Emmanuel Missionary College, Berrien Springs, Mich. 286
KFNA Western State College of Colorado, Gunnison, Colo. 252
KFNJ Fallon & Co. Santa Barbara, Cal. 360
KFNL Penn College Oskaloosa, Iowa 240
KFNR Star Electric & Radio Co. Seattle, Wash. 283
KFI Earle C. Anthony, Inc. Los Angeles, Cal. 469
KFOA Benson Polytechnic Institute Portland, Ore. 360
KFIO North Central High School Spokane, Wash. 252
KFIQ First Methodist Church Yakima, Wash. 242
KFIU Alaska Elec. Light & Power Co., Juneau, Alaska 226
KFIX Reorganized Church of Jesus Christ of Later Day Saints, Independence, Mo. 268
KFIZ Daily Commonwealth and Oscar A. Huelsman, Fond du Lac, Wisconsin 273
KFJB Marshall Electric Co. Marshalltown, Iowa 248
KFJC Seattle Post Intelligencer Seattle, Wash. 270
KFJF National Radio Mfg. Co. Oklahoma City, Okla. 261
KFJI Liberty Theatre Astoria, Ore. 252
KFJK Delano Radio & Electric Co. Bristow, Okla. 213
KFJM University of North Dakota Grand Forks, N. D. 280
KFJR Electric Construction Co., Valley Radio Division, Grand Forks, N. D. 280
KFJS Ashley, C. Dixon & Son Stevensville, Mont. 256
KFJU Iowa State Teachers College Cedar Falls, Iowa 280
KFJY Tuttwell Radio Co. Fort Dodge, Iowa 246
KFJZ Texas National Guard, 112th Cavalry, Fort Worth, Texas 254
KFKA Colorado State Teachers College Greeley, Colo. 273
KFKB Brinkley-Jones Hospital Association, Milford, Kan. 286
KFKQ Conway Radio Laboratories Conway, Ark. 250
KFKY F. F. Gray, 3200 Richardson St., Butte, Mont. 283
KFKX Westinghouse Electric & Mfg. Co., Hastings, Neb. 341
KFLA Absher Bros. Radio Co. Colorado Springs, Colo. 234
KFLB Signal Electric Mfg. Co. Menominee, Mich. 248
KFLE National Educational Service Denver, Colo. 263
KFLR Bissell Radio Shop Little Rock, Ark. 261
KFLU University of New Mexico Albuquerque, N. M. 254
KFLV Rio Grande Radio Supply House, San Benito, Texas 236
KFLW Swedish Evangelical Mission Church Rockford, Ill. 229
KFLX Missoula Electric Supply Co. Missoula, Mont. 254
KFLZ George B. Clough 1214 40th St., Galveston, Tex. 340
KFMB Atlantic Automobile Co. Atlantic, Iowa 271
KFMC Christian Churches of Little Rock, Little Rock, Ark. 254
KFMQ University of Arkansas Fayetteville, Ark. 261
KFMX Morningside College Sioux City, Iowa 261
KFNF George W. Young, 2219 W. Bryant Ave. Minneapolis, Minn. 234
KFNW M. G. Sateren, 127 Blanche St., Houghton, Mich. 286
KFNX Carleton College Northfield, Minn. 283
KFNY Henry Field Seed Co. Shenandoah, Iowa 254
KFNG Women's Radio Shop Coldwater, Miss. 254
KFNJ Central Mo. State Teachers College, Warrensburg, Mo. 234
KFNL Radio Broadcast Association Paso Robles, Cal. 240
KFNV L. A. Drake, 505 Third St. Santa Rosa, Cal. 234
KFNY Montana Phonograph Co. Helena, Mont. 261
KFNZ Royal Radio Co. Burlingame, Cal. 231
KFOA Rhodes Dept. Store Seattle, Wash. 455
KFOC First Christian Church Whittier, Cal. 236
KFOD The Radio Shop Wallace, Idaho 224
KFOF Rhorer Electric Co. Marshfield, Ore. 240
KFOJ Moberly High School Radio Club Moberly, Mo. 246
KFOL Leslie M. Schafbuch, 502 W. Marion St., Marengo, Iowa 234
KFON Echophone Radio Shop Long Beach, Cal. 234
KFOO Latter Day Saints University, Salt Lake City, Utah 261
KFOR David City Tire & Electric Co., David City, Neb. 226
KFOT College Hill Radio Club Wichita, Kans. 231
KFOU Hommel Manufacturing Co. Richmond, Cal. 254
KFOX Technical High School Omaha, Neb. 248
KFOY Beacon Radio Service St. Paul, Mich. 240
KFOZ Leon Hudson Real Estate Co., Fort Smith, Ark. 233
KFPG Garretson & Dennis Los Angeles, Cal. 238
KFPH Howard C. Mallander, 902 Lake St., Salt Lake City, Utah 242
KFPL C. C. Baxter, 205 Grafton St. Dublin, Texas 242
KFPM New Furniture Co. Greenville, Texas 242
KFPN Missouri National Guard, 70th Infantry Brigade, Jefferson City, Mo. 242
KFPO Colorado National Guard, Forty-fifth Division Tank Co., Denver, Colo. 231
KFPP G. & G. Radio & Electric Shop. Olympia, Wash. 236
KFPR Los Angeles County Forestry Department, Los Angeles, Cal. 231
KFPT Cope & Johnson Salt Lake City, Utah 268
KFPY Heintz & Kohlmoos San Francisco, Cal. 236
KFPW St. John's Church Carterville, Mo. 268
KFPX First Presbyterian Church Pine Bluff, Ark. 242
KFPY Symons Investment Co. Spokane, Wash. 283
KFQA The Principia, 5539 Page Ave., St. Louis, Mo. 261
KFQB Searchlight Publishing Co., Fort Worth, Texas 254
KFQC Kidd Brothers Radio Shop Taft, Cal. 227
KFQD Chovin Supply Co. Anchorage, Alaska 280
KFQE Dickenson, Henry, Radio Laboratories, Colorado Springs, Colo. 224
KFQF Donald A. Boult, 2544 Pleasant Ave., Minneapolis, Minn. 224
KFQG Southern California Radio Association, Armory Exposition Park, Los Angeles, Cal. 226
KFQH Albert Sherman, Hillsbourgh Box 51, Burlingame, Cal. 231
KFQI Thomas H. Ince Corp. Culver City, Cal. 254
KFQJ Harbour-Longmire Co. Oklahoma City, Okla. 236
KFQK Democrat Leader Fayette, Mo. 236
KFQL Oklahoma Free State Fair Association, Muskogee, Okla. 252
KFQM Texas Highway Bulletin Austin, Texas 268
KFQN Third Baptist Church Portland, Oregon 283
KFQO Meier Radio Shop Russell, Kansas 261
KFQR Walter L. Ellis, 625 East 0th St., Oklahoma City, Okla. 250
KFQT Texas National Guard, Thirty-sixth Signal Co. Denison, Texas 252
KFQU W. Riker Holy City, Cal. 234
KFQV Omaha Grain Exchange Omaha, Neb. 231
KFQW C. F. Knierim Photo, Radio & Electric Shop, North Bend, Wash. 248
KFQX Alfred M. Hubbard, 310 Green Bldg., Seattle, Wash. 233
KFQY Farmers State Bank Beiden, Neb. 273
KFQZ Taft Radio Co., 5653 De Longpre Ave., Hollywood, Cal. 240
KFRA Marvin S. Olson Carver, Minn.
KFRC Radicart Studio San Francisco, Cal. 280
KFRF W. R. Brown Alexandria, La. 242
KFRG Cleveland High School St. Louis, Mo. 236
KFRH The Radio Shop Grafton, N. D. 268
KFRI Reynolds Radio Co., 1534 Glenarm St., Denver, Colo. 224
KFRJ Guy Simmons, Jr., 515 Clifton St. Conway, Ark. 250
KFRL Men's Club of First Presbyterian Church, Grand Forks, N. Dak. 240
KFRM Lieut. James P. Boland, U. S. A., Fort Sill, Okla. 263
KFRO Curtis Printing Co., 1109 8th Ave., Fort Worth, Texas 246
KFRX J. Gordon Klemguard Pullman, Wash.
KFSG Echo Park Evangelistic Association, Los Angeles, Cal. 278
KFSY Van Blaricom Co., 20 So. Main St., Helena, Mont. 261
KGB Tacoma Daily Ledger Tacoma, Wash. 252
KGG Haliock & Watson Radio Service, Portland, Ore. 360
KGO General Electric Co. Oakland, Cal. 312
KGU Marion A. Mulrony Honoluiu, Hawaii 360
KGW Portland Morning Oregonian Portland, Ore. 492
KGY St. Martin's College Lacey, Wash. 256
KHJ Times Mirror Co. Los Angeles, Cal. 395
KHQ Louis Wasmer Seattle, Wash. 360
KIQ C. O. Gould Stockton, Cal. 278
KJR Northwest Radio Service Seattle, Wash. 263
KJS Bible Institute of Los Angeles, Los Angeles, Cal. 360
KLS Warner Bros. Radio Supplies Co., Oakland, Cal. 360
KLX Tribune Publishing Co. Oakland, Cal. 360
KLZ Reynolds Radio Co. Denver, Colo. 263
KMJ San Joaquin Lt. & Power Corp. Fresno, Cal. 248
KMO Love Electric Co. Tacoma, Wash. 360
KNT Walter Hemrich Rukak Bay, Alaska 263
KNX "Hollywood" Los Angeles Evening Express 337
KOB New Mexico College of Agriculture and Mechanic Arts, State College, N. M. 360
KOP Detroit Police Dept. Detroit, Mich. 286
KPO Hale Bros. San Francisco, Cal. 423
KQP Apple City Radio Club Hood River, Ore. 360
KQV Doubleday Hill Electric Co. Pittsburgh, Pa. 270
KQW Chas. D. Herrold, 407 First St., San Jose, Cal. 360
KRE Berkeley Daily Gazette Berkeley, Cal. 275
KSD Post Dispatch (Pulitzer Pub. Co.), St. Louis, Mo. 546
KTW First Presbyterian Church Seattle, Wash. 360
KUO Examiner Printing Co. San Francisco, Cal. 360
KWG Portable Wireless Telephone Co., Stockton, Cal. 360
KWH Los Angeles Examiner Los Angeles, Cal. 360
KYQ Electric Shop Honoluiu, Hawaii 370
KYW Westinghouse Elec. & Mfg. Co. Chicago, Ill. 536
KZM Preston D. Allen, 13th & Franklin Sts., Oakland, Cal. 360
WAAB Valdemar Jensen, 137 S. St. Patrick St., New Orleans, La. 256
WAAC Tulane University New Orleans, La. 360
WAAD Ohio Mechanics Institute Cincinnati, Ohio 360
WAAF Chicago Daily Drover's Journal Chicago, Ill. 536
WAAM I. R. Nelson Co. Newark, N. J. 263
WAAN University of Missouri Columbia, Mo. 254
WAAW Omaha Grain Exchange Omaha, Neb. 268
WABB Harrisburg Sporting Goods Co., Harrisburg, Pa. 256
WABD Parker High School Dayton, Ohio 283
WABH Lake Shore Tire Co. Sandusky, Ohio 240
WABI Bangor Railway & Electric Co. Bangor, Me. 240
WABL Connecticut Agricultural College Storrs, Conn. 283
WABM F. E. Doherty Automotive & Radio Equipment Co., Saginaw, Mich. 254
WABN Ott Radio, Inc., 1627 State St., La Crosse, Wis. 244
WABO Lake Ave. Baptist Church, Rochester, N. Y. 283
WABP Robert F. Weinig, 532 Wooster Ave., Dover, Ohio 296
WABQ Haverford College Radio Club Haverford, Pa. 261
WABR Scott High School Toledo, Ohio 270
WABU Victor Talking Machine Co. Camden, N. J. 226
WABW College of Wooster Wooster, Ohio 254
WABX Henry B. Joy Mount Clemens, Mich. 270
WABY John Magaldi, Jr., 815 Kimball St., Phila., Pa. 242
WABZ Coliseum Place Baptist Church, New Orleans, La. 263
WAHG A. H. Grebe Co. Brooklyn, N. Y. 316
WBAA Purdue University West Lafayette, Ind. 283
WBAH Wireless Phone Corporation Paterson, N. J. 244
WBAO James Millikin University Decatur, Ill. 275
WBAP Wortham-Carter Publishing Co. (Star-Telegram), Fort Worth, Texas 476
WBAV Erner & Hopkins Co. Columbus, Ohio 423
WBAX John H. Stenger, Jr., 66 Glidersleeve St., Wilkesbarre, Pa. 360
WBAY The Western Electric Co. New York, N. Y. 492
WBBD Barbey Battery Service Reading, Pa. 234
WBBF Georgia School of Technology Atlanta, Georgia 270
WBBG Irving Vermilya Mattapoisett, Mass. 240
WBBH J. Irving Bell, 1511 Gordon St., Port Huron, Mich. 248
WBBL Grace Covenant Church Richmond, Va. 261
WBBP Petoskey High School Petoskey, Mich. 246
WBBR Peoples Pulpit Association Rossville, N. Y. 273
WBBS First Baptist Church New Orleans, La. 252
WBBT Lloyd Brothers Philadelphia, Pa. 234
WBBU Jenks Motor Sales Co. Monongahela, Pa. 234
WBBV Johnstown Radio Co. Johnstown, Pa. 248
WBBW Ruffner Junior High School Norfolk, Va. 222
WBBY Washington Light Infantry, Charleston, S. C. 360
WBBZ Noble B. Watson, 233 Iowa St., Indianapolis, Ind. 227
WBL T & H Radio Co. Asbury, Kansas 244
WBS D. W. May (Inc.) Newark, N. J. 280
WBT Southern Radio Corp. Charlotte, N. C. 360
WBZ Westinghouse Elec. & Mfg. Co., Springfield, Mass. 337
WCAD St. Lawrence University Canton, N. Y. 280
WCAE Kaufman & Baer Co. Pittsburgh, Pa. 462
WCAG Clyde R. Randall, 2813 Calhoun St., New Orleans, La. 268
WCAH Entrekin Electric Co. Columbus, Ohio 296
WCAJ Nebraska Wesleyan University, University Place, Nebr. 290
WCAK Alfred P. Daniel, 2504 Bagby St., Houston, Texas 282
WCAL St. Olaf College Northfield, Minn. 356
WCAO The Sanders and Stayman Co., Baltimore, Md. 275
WCAP Chesapeake & Potomac Telephone Co., Washington, D. C. 469
WCAR Southern Radio Corp. of Texas, San Antonio, Texas 350
WCAS Wm. Hook Dunwoody Industrial Institute, Minneapolis, Minn. 280
WCAT South Dakota State School of Mines, Rapid City, S. D. 240
WCAU Durham & Co. Philadelphia, Pa. 396
WCAV J. C. Dice Electric Co. Little Rock, Ark. 250
WCAX University of Vermont Burlington, Vt. 360
WCAY Milwaukee Civic Broadcasting Station, Hotel Antlers, Milwaukee, Wis. 396
WCBA Charles W. Heimbach, 1015 Allen St., Allentown, Pa. 286
WCBC University of Michigan Ann Arbor, Mich. 286
WCBD Wilbur G. Voliva Zion, Ill. 345
WCBE Uhalt Radio Co. New Orleans, La. 263
WCBG Howard S. Williams Pascagoula, Miss. 288
WCBH University of Mississippi Oxford, Miss. 242
WCBI Nicoll, Duncan & Bush Bemis, Tenn. 248
WCBJ J. C. Mans Jennings, La. 244
WCBK E. Richard Hall, 2201 Central Ave., St. Petersburg, Fla. 286
WCBL Northern Radio Mfg. Co. Houlton, Me. 280
WCBM Charles Schwarz, Charles and North Aves., Baltimore, Md. 225
WCBO Radio Shop (Inc.) Memphis, Tenn. 256
WCBQ First Baptist Church Nashville, Tenn. 256
WCBR Charles H. Messter Providence, R. I. 240
WCBT Clark University Worcester, Mass. 238
WCBU Arnold Wireless Supply Co. Arnold, Pa. 234
WCBV Tullahoma Radio Club Tullahoma, Tenn. 232
WCBW George P. Rankin, Jr., and Maitland Solomon, Macon, Ga. 228
WCBY Forks Electrical Shop Buck Hill Falls, Pa. 280
WCBZ Coppotelli Brothers Music House, Chicago Heights, Ill. 248
WCCO Washburn Crosby Co., 200 Chamber of Commerce, Minneapolis, Minn. 417
WCK Stix Baer & Fuller Dry Goods Co., St. Louis. 360
WCX The Detroit Free Press Detroit, Mich. 517
WDAE Tampa Daily Times Tampa, Fla. 360
WDAF Kansas City Star Kansas City, Mo. 411
WDAG J. Laurence Martin Amarillo, Tex. 263
WDAH Trinity Methodist Church (South), El Paso, Tex. 256
WDAR Lit Bros. Philadelphia, Pa. 395
WDAS Sam Waite's Radio Shop Worcester, Mass. 256
WDAU Sloeum & Kilburn New Bedford, Mass. 360
WDAY Radio Equipment Corp. Fargo, N. D. 244
WDBB A. H. Waite & Co. Taunton, Mass. 229
WDBC Kirk Johnson & Co. Lancaster, Pa. 256

WDBD Herman E. Burns.....Martinsburg, W. Va. 288
WDBF Robert G. Phillips.....Youngstown, Ohio 246
WDBH C. T. Sherer Co.....Worcester, Mass. 268
WDBI Radio Specialty Co.....St. Petersburg, Fla. 226
WDBJ Richardson-Wayland Electrical Corp., Roanoke, Va. 229
WDBK M. F. Broz, Furniture, Hardware & Radio Co., Cleveland, Ohio 248
WDBN Maine Electric Light and Power Co..Bangor, Me. 252
WDBO Rollins College.....Winter Park, Fla. 240
WDBP Superior State Normal School....Superior, Wis. 261
WDBQ Morton Radio Supply Co.....Salem, N. J. 234
WDBR Tremont Temple Baptist Church....Boston, Mass. 256
WDBS S. M. K. Radio Corp.....Dayton, Ohio 283
WDBT Taylor's Book Store.....Hattiesburg, Miss. 236
WDBV Strand Theatre.....Fort Wayne, Ind. 258
WDBW The Radio Den.....Columbia, Tenn. 268
WDBX Otto Baur, 138 Dyckman St., New York, N. Y. 233
WDBY North Shore Congregational Church..Chicago, Ill. 258
WDBZ Boy Scouts of America, Ulster County Council, Kingston, N. Y. 233
WDM The Church of the Covenant...Washington, D. C. 234
WDZ J. L. Bush.....Tuscola, Ill. 278
WEAA Frank D. Fallain, Police Building..Flint, Mich. 280
WEAF American Telephone & Telegraph Co., New York, N. Y. 492
WEAH Wichita Board of Trade.....Wichita, Kan. 280
WEAI Cornell University.....Ithaca, N. Y. 286
WEAJ University of South Dakota...Vermillion, S. D. 283
WEAM Borough of North Plainfield, North Plainfield, N. J. 280
WEAN Shepard Co.....Providence, R. I. 273
WEAO The Ohio State University.....Columbus, Ohio 360
WEAP Mobile Radio Co.....Mobile, Ala. 360
WEAU Davidson Bros. Company.....Sioux City, Iowa 275
WEAY Iris Theatre.....Houston, Texas 360
WEB Renwood Co.....St. Louis, Mo. 273
WEBA The Electric Shop.....Highland Park, N. J. 233
WEBC Walter C. Bridges.....Superior, Wis. 242
WEBD Electrical Equipment Service Co..Anderson, Ind. 246
WEBE Roy W. Waller.....Cambridge, Ohio 248
WEBH Edgewater Beach Hotel Co.....Chicago, Ill. 370
WEBI Walter Gibbons.....Salisbury, Md. 242
WEBJ Third Ave. Ry. Co.....New York City 273
WEBK Grand Rapids Radio Co....Grand Rapids, Mich. 261
WEBL R. C. A. United States (portable).....226
WEBP Spanish Fort Amusement Park..New Orleans, La. 280
WEBQ Tate Radio Co.....Harrisburg, Ill. 226
WEBR H. H. Howell.....Buffalo, N. Y. 240
WEBT Dayton Cooperative Industrial High School, Dayton, Ohio 270
WEBU De Land Piano & Music Co.....De Land, Fla. 258
WEBW Beloit College.....Beloit, Wis. 283
WEBX Nashville, Tenn., R. R. No. 9, Franklin Pike, Johen E. Cain Jr. 263
WEBY Hobart Radio Co.....Rolindale, Mass. 226
WEBZ Savannah Radio Corp.....Savannah, Ga. 280
WEV Hurlburt-Still Electrical Co.....Houston, Texas 263
WEW St. Louis University.....St. Louis, Mo. 280
WFAA The Dallas News, The Dallas Journal, Dallas, Texas 476
WFAM Times Publishing Co.....St. Cloud, Minn. 273
WFAN Hutchinson Electric Service Co., Hutchinson, Minn. 286
WFAV University of Nebraska.....Lincoln, Neb. 273
WFBB Eureka College.....Eureka, Ill. 240
WFBG William F. Gable Co.....Altoona, Pa. 261
WFBH Concourse Radio Corp.....New York City 273
WFBJ Galvin Radio Supply Co.....Camden, N. J. 236
WFBK Dartmouth College.....Hanover, N. H. 256
WFBL Onondaga Hotel.....Syracuse, N. Y. 286
WFBM Merchants Heat & Light Co., 519 Guaranty Building, Indianapolis, Ind. 268
WFBN Radio Sales & Service Co., 1 Broad St., Bridgewater, Mass. 226
WFBQ Wynne Radio Co., 226 Fayetteville St., Raleigh, N. C. 252
WFBR Fifth Infantry, Maryland N. G., Fifth Regiment Armory, Baltimore, Md. 254
WFBT Gloucester County Civic League...Pitman, N. J. 231
WFBU Commonwealth Radio Association...Boston, Mass.
WFI Strawbridge & Clothier.....Philadelphia, Pa. 395
WGAL Lancaster Elec. Supply & Const. Co., Lancaster, Pa. 246
WGAN Cecil E. Lloyd, 216 W. Romana St., Pensacola, Fla. 360
WGAQ Youree Hotel.....Shreveport, La. 252
WGAZ The South Bend Tribune.....South Bend, Ind. 360
WGBA Jones Elec. & Radio Mfg. Co....Baltimore, Md. 254
WGBS Gimbel Brothers.....New York City 316
WGI American Radio & Research Corp., Medford Hillside, Mass. 360
WGL Thomas F. J. Howlette, 2303 N. Broad St., Philadelphia, Pa. 360
WGN Drake Hotel.....Chicago, Ill. 370
WGR Federal Telephone Mfg. Co....Buffalo, N. Y. 319
WGY General Electric Co.....Schenectady, N. Y. 380
WHA University of Wisconsin.....Madison, Wis. 283
WHAA State University of Iowa.....Iowa City, Iowa 484
WHAD Marquette University.....Milwaukee, Wis. 280
WHAG University of Cincinnati.....Cincinnati, Ohio 222
WHAM University of Rochester.....Rochester, N. Y. 283
WHAR Seaside Hotel.....Atlantic City, N. J. 275
WHAS Courier Journal and Louisville Times, Louisville, Ky. 400
WHAV Wilmington Electrical Specialty Co., Inc., Wilmington, Del. 360
WHAZ Rensselaer Polytechnic Institute.....Troy, N. Y. 380
WHB Sweeney School Co.....Kansas City, Mo. 411
WHK Radiovox Co.....Cleveland, Ohio 283
WHN George Schubel, Loew's State Theatre Building, New York City 360
WHO Bankers Life Co.....Des Moines, Iowa 526
WIAB Art A. Johnson's Garage.....Rockford, Ill. 252
WIAC Galveston Tribune.....Galveston, Texas 360
WIAD Howard R. Miller, 6318 N. Park Ave., Philadelphia, Pa. 254
WIAK Journal-Stockman Co.....Omaha, Neb. 278
WIAS Home Electric Co.....Burlington, Iowa 283
WIK K. & L. Electric Co.....McKeesport, Pa. 234
WIP Gimbel Brothers.....Philadelphia, Pa. 509
WJAB American Electric Co.....Lincoln, Neb. 229
WJAD Jackson's Radio Engineering Laboratories, Waco, Texas 360
WJAG The Norfolk Daily News.....Norfolk, Neb. 283
WJAK Clifford L. White.....Greentown, Ind. 254
WJAM D. M. Perham, 332 Third Ave., W. Cedar Rapids, Iowa 268
WJAN Peoria Star.....Peoria, Ill. 280
WJAR The Outlet Co.....Providence, R. I. 360
WJAS Pittsburgh Radio Supply Co.....Pittsburgh, Pa. 296
WJAX Union Trust Co.....Cleveland, Ohio 390
WJAZ Chicago Radio Laboratory.....Chicago, Ill. 268
WJD Denison University.....Granville, Ohio 229
WJJD Mooseheart.....Mooseheart, Ill. 278
WJY R. C. A.....New York City 405
WJZ R. C. A.....New York City 455
WKAA H. F. Paar, 1444 Second Ave. E., Cedar Rapids, Iowa 278
WKAD Charles Looff (Crescent Park), East Providence, R. I. 240
WKAF W. S. Radio Supply Co....Wichita Falls, Texas 360
WFAN United Battery Service Co.....Montgomery, Ala. 226
WKAP Dutee W. Flint.....Cranston, R. I. 360
WKAQ Radio Corp. of Porto Rico.....San Juan, P. R. 360
WKAR Michigan Agricultural College, East Lansing, Mich. 280
WKAV Laconia Radio Club.....Laconia, N. H. 254
WKBF Dutee W. Flint.....Cranston, R. I. 286
WKY W. K. Y. Radio Shop.....Oklahoma City, Okla. 360
WLAL Naylor Electrical Co.....Tulsa, Okla. 360
WLAP W. V. Jordan, 306 W. Breckenridge St., Louisville, Ky. 286
WLAX Greencastle Community Broadcasting Station, Greencastle, Ind. 231
WLB University of Minnesota at Minneapolis, Minn.
WLBL Wisconsin Department of Markets, Stevens Point, Wis. 278
WLS Sears, Roebuck & Co.....Chicago, Ill. 245
WLW Crosley Radio Corp.....Cincinnati, Ohio 423
WMAC Clive B. Meredity.....Cazenovia, N. Y. 261
WMAF Round Hills Radio Corp.....Dartmouth, Mass. 360
WMAH General Supply Co.....Lincoln, Neb. 254
WMAK Northern Laboratories.....Lockport, N. Y. 273
WMAN First Baptist Church.....Columbus, Ohio 286
WMAQ Chicago Daily News.....Chicago, Ill. 448
WMAV Alabama Polytechnic Inst.....Auburn, Ala. 250
WMAY Kingsbighway Presbyterian Church, St. Louis, Mo. 280
WMAZ Mercer University.....Macon, Ga. 261
WMC Commercial Appeal.....Memphis, Tenn. 500
WME Intercity Radio Telegraph Co., McDougal Terminal Bldg., Duluth, Minn.
WMH Ainsworth-Gates Radio Co.....Cincinnati, Ohio 309
WMU Doubleday-Hill Electric Co....Washington, D. C. 261
WNAC Shepard Stores.....Boston, Mass. 278
WNAD University of Oklahoma.....Norman, Okla. 254
WNAL Omaha Central High School.....Omaha, Neb. 258
WNAP Wittenberg College.....Springfield, Ohio 275
WNAR First Christian Church.....Butler, Mo. 231
WNAT Lemmi Bros. Co.....Philadelphia, Pa. 250
WNAW Henry Kunzmann, Box 167.....Fort Monroe, Va. 360
WNAX Dakota Radio Apparatus Co.....Yankton, S. D. 244
WNJ Radio Shop of Newark.....Newark, N. J. 233
WNYC City of New York.....New York, N. Y. 526
WOAC Page Organ Co.....Lima, Ohio 286
WOAE Midland College.....Fremont, Neb. 280
WOAF Tyler Commercial College.....Tyler, Texas 360
WOAI Southern Equipment Co.....San Antonio, Texas 385
WOAJ Ervin Electrical Co.....Parsons, Kan. 258
WOAN Vaughn Conservatory of Music, Lawrenceburg, Tenn. 360
WOAR Henry P. Lundskow.....Kenosha, Wis. 229
WOAV 2nd Battalion, 112th Inf., P. N. G....Erie, Pa. 242
WOAW Woodmen of the World.....Omaha, Neb. 526
WOAX Franklyn J. Wolff, 600 Ingham Ave., Trenton, N. J. 240
WOC The Palmer School of Chiropractic, Davenport, Iowa 484
WOI Iowa State College.....Ames, Iowa 360
WOO John Wanamaker.....Philadelphia, Pa. 509
WOQ Western Radio Co.....Kansas City, Mo. 360
WOR L. Bamberger & Co.....Newark, N. J. 405
WOS Missouri State Marketing Bureau, Jefferson City, Mo. 441
WPAB Pennsylvania State College, State College, Pa. 283
WPAC Donaldson Radio Co.....Okmulgee, Okla. 360
WPAJ Doolittle Radio Corp.....New Haven, Conn. 268
WPAK North Dakota Agricultural College, Agricultural College, N. D. 283
WPAR Ward Battery & Radio Co.....Beloit, Kan. 236
WPAU Concordia College.....Moorhead, Minn. 286
WPAZ Dr. John R. Koch.....Charleston, W. Va. 360
WQAA Horace A. Beale, Jr.....Parkesburg, Pa. 360
WQAC Black Radio Service.....Amarillo, Tex. 234
WQAE Moore Radio News Station.....Springfield, Vt. 275
WQAF Sandusky Register.....Sandusky, Ohio 240
WQAM Electrical Equipment Co.....Miami, Fla. 283
WQAN Scranton Times.....Scranton, Pa. 280
WQAO Calvary Baptist Church.....New York, N. Y. 360
WQAS Prince-Waiter Co.....Lowell, Mass. 256
WQAX Radio Equipment Co.....Peoria, Ill. 248
WQJ Calumet Rainbo Broadcasting Co....Chicago, Ill. 448
WRAF The Radio Club.....Laporte, Ind. 224
WRAL Northern States Power Co., St. Croix Falls, Wis. 248
WRAM Lombard College.....Galesburg, Ill. 244
WRAN Black Hawk Electrical Co.....Waterloo, Iowa 236
WRAO St. Louis Radio Service Co.....St. Louis, Mo. 360
WRAV Antioch College.....Yellow Springs, Ohio 242
WRAW Avenue Radio Shop.....Reading, Pa. 238
WRAX Flexons Garage.....Gloucester City, N. J. 268
WRBC Immanuel Lutheran Church.....Vaiparaiso, Ind. 278
WREO Reo Motor Car Co.....Lansing, Mich. 288
WRC Radio Corp. of America.....Washington, D. C. 469
WRK Doron Bros. Elec. Co.....Hamilton, Ohio 360
WRL Union College.....Schenectady, N. Y. 360
WRM University of Illinois.....Urbana, Ill. 273
WRR City of Dallas Police and Fire Signal Dept., Dallas, Texas 360
WRW Tarrytown Radio Research Laboratory, Tarrytown, N. Y. 273
WSAB South East Missouri State Teachers College, Cape Girardeau, Mo. 360
WSAC Clemson Agricultural College, Clemson College, S. C. 360
WSAD J. A. Foster Co.....Providence, R. I. 261
WSAI United Playing Card Co.....Cincinnati, Ohio 309
WSAJ Grove City College.....Grove City, Pa. 360
WSAP Seventh Day Adventist Church, N. Y. C., N. Y. 263
WSAR Doughty & Welch Elec. Co....Fall River, Mass. 254
WSAU Camp Marienfeld.....Chesham, N. H. 229
WSAV Clifford W. Vick Radio Construction Co., Houston, Texas 360
WSAZ Chas Electric Shop.....Pomeroy, Ohio 258
WSB Atlanta Journal.....Atlanta, Ga. 429
WSL J. & M. Electric Co.....Utica, N. Y. 273
WSOE School of Engineering of Milwaukee, Milwaukee, Wis. 246
WSY Alabama Power Co.....Birmingham, Ala. 360
WTAB Fall River Daily Herald Pub. Co., Fall River, Mass. 260
WTAC Penn. Traffic Co.....Johnstown, Pa. 275
WTAF Louis J. Gallo, 2222 Lapeyrouse St., New Orleans, La. 268
WTAL Toledo Radio & Elec. Co.....Toledo, Ohio 252
WTAM Willard Storage Battery Co.....Cleveland, Ohio 390
WTAT Cambridge Radio & Elec. Co....Cambridge, Ill. 242
WTAQ S. H. Van Gorden & Son.....Osseo, Wis. 254
WTAR Reliance Elec. Co.....Norfolk, Va. 280
WTAS Charles E. Erbstein, R. F. D. 6, Box 75, Elgin, Ill. 268
WTAT Edison Electric Illuminating Co....Boston, Mass. 244
WTAU Ruegg Battery and Electric Co...Tecumseh, Neb. 242
WTAW Agricultural & Mechanical College, College Station, Texas 286
WTAX Williams Hardware Co.....Streator, Ill. 231
WTAY Oak Leaves Broadcasting Station...Oak Park, Ill. 263
WTAZ Thomas J. McGuire.....Lambertville, N. J. 261
WTG Kansas State Agricultural College, Manhattan, Kan. 275
WTL H. G. Saal Co.....Chicago, Ill. 360
WWAD Wright & Wright, Inc.....Philadelphia, Pa. 360
WWAE Lawrence J. Crowley (Alamo Ball Room), Joliet, Ill. 360
WWAO Michigan College of Mines.....Houghton, Mich. 254
WWJ Ford Motor Co.....Dearborn, Mich. 273
WWJ Detroit News.....Detroit, Mich. 517
WWL Loyola University.....New Orleans, La. 299

Alaska

KFIU Alaska Electric Light & Power Co.....Juneau 278
KFQD Chovin Supply Co.....Anchorage 286
KNT Walter Heinrich.....Kukak Bay 263

Argentina

LOR Cia Radio Argentina.....Buenos Aires 333
LOX Radio Cultura.....Buenos Aires 273
LOZ Radio Sud America.....Buenos Aires 375
TCR Francisco J. Brusa.....Buenos Aires 380

Australia

2CF Farmer & Co., Ltd.....Sydney 1,100
2BL Broadcastings Sydney (Ltd.).....Sydney 353
2AB Associated Radio Co. (Ltd.).....Melbourne 400
6WF West Australian Farmers (Ltd.).....Perth 1,250

Austria

"Radio Wien" Technologische Gewerbmuseum.....Vienna 700
OHW Radio Hekaphon.....Vienna 600

Belgium

SRB No data.....Brussels 405
BAV No data.....Brussels 900

Canada

CFCS Eastern Telephone & Telegraph Co., Halifax, Nova Scotia 410
CFCE Marconi.....Halifax, Nova Scotia 440
CHAC Radio Engineers.....Halifax, Nova Scotia 410
CICI Maritime Radio Corp....St. John, New Brunswick 400
CKCR Jones Electric Co.....St. John, New Brunswick 400
CFCE Marconi.....Montreal, Quebec 440
CHYC Northern Electric Co.....Montreal, Quebec 410
CJBC Depuis Frères.....Montreal, Quebec 435
CKAC La Presse Publishing Co.....Montreal, Quebec 435
CFUC University of Montreal.....Montreal, Quebec 400
CHYC Northern Electric Co.....Montreal, Quebec 410
CFCJ La Cie de L'Evenement.....Quebec, Quebec 410
CHCD Canadian Wireless and Electric Co., Quebec, Quebec 410
CFCQ Semmelbaack-Dickson (Ltd.)....Bellevue, Quebec 400
CFPC International Radio Development Co., Fort Frances, Ont. 400
CKOC Wentworth Radio Supply Co., Hamilton, Ontario 410
CJCF The News-Record (Ltd.).....Kitchener, Ont. 420
CHCX J. R. Booth, Jr.....Ottawa, Ont. 400
CFCH Abitibi Power & Paper Co., Iroquois Falls, Ont. 400
CFCR Laurentide Air Service.....Sudbury, Ont. 440
CFRC Queens University.....Kingston, Ont. 400
CFCW Radio Shop.....London, Ont. 430
CJGC Free Press Printing Co.....London, Ont. 430
CKQC Radio Supply Co. (Ltd.).....London, Ont. 410
CHCG London Radio Shoppe.....London, Ont. 410
CHCE Canadian Independent Telephone Co.Toronto, Ont. 450
CFCA Star Publishing & Printing Co., Toronto, Ont. 400
CJCD T. Eaton Co.....Toronto, Ont. 410
CHCB Marconi.....Toronto, Ont. 440
CHVC Metropolitan Motors.....Toronto, Ont. 410
CJCN Simons Agnew & Co.....Toronto, Ont. 410
CJSC Evening Telegram.....Toronto, Ont. 430
CJCG Manitoba Free Press.....Winnipeg, Manitoba 440
CHCF G. Melrose Bell.....Winnipeg, Manitoba 430
CJNC Tribune Newspaper Co.....Winnipeg, Manitoba 400
CKZC Salton Radio Engineering Co., Winnipeg, Manitoba 430
CKY Manitoba Telephone System..Winnipeg, Manitoba 450
CKCK G. Melrose Bell, Leader Publishing Co., Regina, Saskatchewan 428
CFQC The Electric Shop.....Saskatoon, Saskatchewan 400
CGAC G. Melrose Bell.....Calgary, Alberta 430
CHBC Albertan Publishing Co.....Calgary, Alberta 410
CHCQ Western Radio Co.....Calgary, Alberta 400
CFAC Calgary Herald.....Calgary, Alberta 430
CFCN W. W. Grant Radio (Ltd.)....Calgary, Alberta 440
CJCA Edmonton Journal.....Edmonton, Alberta 430
CFCK Radio Supply Co.....Edmonton, Alberta 410
CJCX Percival Wesley Shackleton.....Olds, Alberta 400
CJCE Sprott Shaw Radio Co., Vancouver, British Columbia 430
CKCD Daily Province.....Vancouver, British Columbia 410
CFCD Marconi.....Vancouver, British Columbia 440
CGAC G. Melrose Bell.....Vancouver, British Columbia 440
CHCL Vancouver Merchants Exchange, Vancouver, B. C. 400
CJCB J. G. Bennett Nelson.....British Columbia 400
CFCL Centennial Methodist Church.....Victoria, B. C. 400
CHCE Western Canada Radio Supply Co., (Ltd.) Victoria, B. C. 400
CFDC Sparks Co.....Nanaimo, B. C. 410

Chile

CRC Radio Corporation of Chile.....Santiago, Chile 400
ABC Radio Corporation of Chile, Vina del Mar, Chile 400

Cuba

PWX Cuban Telephone Co.....Habana, Cuba 400
2DW Pedro Zayas.....Habana, Cuba 360
2AB Alberto S. Bustamente.....Habana, Cuba 240
2OK Mario Garcia Velez.....Habana, Cuba 360
2DY Frederick W. Borton.....Habana, Cuba 370
2CX Frederick W. Borton.....Habana, Cuba 370
2EV Westinghouse Elec. Co.....Habana, Cuba 220
2TW Roberto E. Ramirez.....Habana, Cuba 220
2HC Heraldo de Cuba.....Habana, Cuba 275
2LC Luis Casas.....Habana, Cuba 220
2KD E. Sanchez Fuentes.....Habana, Cuba 275
2NN Fausto Simon.....Habana, Cuba 220
2BG Manuel G. Salas.....Habana, Cuba 220
2JQ Raul Peres Falcon.....Habana, Cuba 180
2KP Alvaro Daza.....Habana, Cuba 200
2HS Julio Power.....Habana, Cuba 180
2OL Oscar Collado.....Habana, Cuba 210
2WW Amadeo Saens.....Habana, Cuba 360
5EV Leopoldo V. Figueroa.....Colon, Cuba 340
5KW Frank H. Jones.....Tuinucu, Cuba 360
6KJ Frank H. Jones.....Tuinucu, Cuba 275
6CX Antonio T. Figueroa.....Cienfuegos, Cuba 175
6DW Eduardo Terry.....Cienfuegos, Cuba 220
6BY Jose Ganduxe.....Cienfuegos, Cuba 220
6AZ Valentin Ullivarri.....Cienfuegos, Cuba 220
6EV Josefa Alvarez.....Caibarien, Cuba 225
7AZ Pedro Nogueros.....Camaguey, Cuba 220
7BY Salvador Rionda.....Camaguey, Cuba 220
8AZ Alfredo Broocks.....Santiago, Cuba 200
8BY Alberto Ravelo.....Santiago, Cuba 225
8FU Andres Vinnet.....Santiago, Cuba 275
8DW Pedro C. Andus.....Santiago, Cuba 180
8EV Eduardo Mateo.....Santiago, Cuba 200
8GT Juan F. Chibas.....Santiago, Cuba

Afloat and Ashore with the Operator

By W. S. Fitzpatrick

ALTHOUGH I am sure you at least know of him, the identity of the old timer who tells this little story is concealed for reasons which you might guess.

A man entered his radio cabin aboard a ship some years ago and excitedly wrote out a message to the New York Police Department telling of a girl being held prisoner in a certain vacant loft in that city.

How did he know, so far out at sea? He had just had a vivid dream!

A conference was held with the captain who admitted that he knew of dreams that were true, citing a case when he was mate on a sailing vessel on which the captain was awakened from a violent dream shortly after leaving a port in Australia.

Rushing out of his room the sailing ship master cried out to the man at the wheel:

"There he is; put 'er over to the course he's pointing at."

The wheelsman and the mate were awestruck to see a white-bearded old man standing behind the compass pointing sharply with a steady, withered finger to a point several degrees off their course.

The wheel was swung around until the ship was headed in the direction indicated and the vision disappeared. Never before did the vessel steer so well nor did she ever make such speed. In a surprisingly short time a life boat of a wrecked ship was sighted.

The entire crew of the ship was in the boat, all completely exhausted but alive—excepting one old man who lay in the bottom. The others had not known he had died.

The dead member was readily identified as the vision in the captain's dream and as the one who by pointing at the compass, changed the course of the ship.

With this experience in mind, and with the passenger's insistent manner, the captain told the operator to use his own judgment.

Out into the air, then, shot the message to the New York Police and the passenger went to his stateroom for an afternoon nap—and another dream.

Rushing back to the radio cabin he told how the girl had been taken from the loft and was being rowed up the Hudson River in a small boat, which at that particular moment was off Twenty-third Street.

Another message to the police and the man went away to dream some more. And dream he did, but this time the captain and the radio operator felt that the police would have to wait until the ship's arrival to learn further details of the kidnaping.

The following day upon docking representatives of the police went aboard in a rather angry mood. They said they had visited the loft—which by queer coincidnce actually was at the address given—and had used axes in smashing their way in, doing much damage but finding no girl, criminals or clues to their quest. The receipt of the other message caused an investigation up the North River without results.

It was also learned that the police were under the impression that the steamer was outbound from New York; that a member of a gang had slipped away, become conscience-stricken and decided to "squeal" on his fellows.

* * *

WE congratulate the *Equitable Envoy,* of the Equitable Trust Company of New York, not only on its clever editorial and mechanical presentation but on its being the first house organ to institute a radio department—and a highly interesting one at that!

* * *

AMONG the varieties in the life of a sea-going radio man are the entertainments held by passengers. There is no end to diversion, depending of course, on "the crowd."

As likely as not professional entertainers may be aboard but clever amateur talent is always prevalent in musical comedies, concerts, playlets and minstrel shows.

A dance on deck furnishes a delightful and thrilling evening, and color is added to the fascinating scene when a masquerade ball is the evening's program.

The form of shipboard entertainment that always held my greatest interest, however, was the mock trial. There was one in particular which lingers in my memory. On this occasion a real judge and two well known lawyers acted the principal roles.

To make up the case a girl entered suit for divorce against an actor and the opposing lawyers spent the day preparing their briefs and issuing subpenas for witnesses.

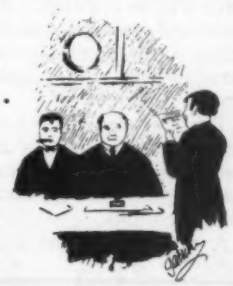
The plaintiff's lawyer visited the radio cabin and requested a "received" radiogram to be used as "evidence."

His request was refused on the ground of it being against all telegraph rules to give away this form, either in blank or containing other than a legitimate message.

A compromise was effected by giving a "sending" blank and allowing use of the station's typewriter. This result became "Exhibit A" in the proceedings.

Picking the jury was the first exciting event of the trial. Most of the passengers had been served with subpenas so, of course, could not be jurors.

In due course "Exhibit A" was introduced. Up to this time it had been noticed that the two lawyers had been battling as though their future careers depended upon the outcome of the trial. The entire dining saloon — now transformed into a real court room— was breathless with excitement and the introduction of the radiogram brought on the climax.



One glance at the copy and the defendant's lawyer moved that a summons be issued for the wireles operator to appear before the court imme-

(*Turn to page* 93)

One-Tube Transmitting Circuits

A host of twisted one-tube transmitting circuits unraveled and the basic idea of power conversion through the use of a three-element vacuum tube brought to light

By John R. Meagher

Author of "How to Make a One-Tube Reflex Set That's a 'Knock-Out.'"

THE influence of the draftsman upon the "development" of radio circuits is to be felt just as deeply in the transmitting as in the receiving field. Merely through exercise of his artistic imagination he can and indeed as we shall see he has transformed one circuit into a multitude of forms apparently entirely unlike each other.

In this article we shall endeavor to unravel the host of twisted one-tube transmitting circuits and bring to light that which is basic in the fundamental idea of power conversion through use of a three element vacuum tube.

We have but one thought in doing this; and that is to help the art.

For a complete understanding we must first consider two main points before delving into our subject.

The First Point

The draftsman represents an "inductance" L as shown in figure A. Actually an inductance has resistance, r, and capacity, c, so a more correct representation would be like that shown at B; it is evident that an inductance is really a complete circuit.

Any circuit has a "natural period," *i. e.*, is resonant to some particular frequency. An electrical force varying at the resonant frequency and tending to flow through the circuit will be hindered; that is, the progress of the force will be impeded. As a result the impressed voltage will be "built up" across the circuit—in somewhat the same fashion as a stream is built up against a dam.

The impedance of a circuit to an electrical force varying at its resonant frequency is in many ways similar to the property of resistance in direct voltage circuits.

A circuit has some smaller value of impedance or none at all to an electrical force varying at a rate differing from the natural period of the circuit. To effectively impede an electrical force it is necessary that the rate of variation or frequency of the force and the natural period of the circuit be identical. This condition of resonance may be brought about either by changing the frequency of the force or by changing the natural period of the circuit. The natural period of a circuit may be changed by varying either the inductance or the capacity or both. The process is known as tuning.

As any circuit has a natural period it may be considered as a tuned-impedance for that frequency. And it is a tuned-impedance even though neither the inductance nor the capacity can be varied. If the circuit constants—capacity, inductance and resistance—are fixed the circuit may correctly be termed a fixed tuned-impedance. If either one or all the constants can be varied, the circuit should properly be termed an adjustable tuned-impedance.

Now at C, D, E and F are shown several adjustable tuned-impedance circuits; a fixed tuned-impedance is represented at G. For resonant conditions these circuits are all alike and any one may be substituted for the other. This despite the fact that the draftsman in representing the circuits in their material rather than electrical form has made each look different from the other.

It is obvious that if we follow the general custom and call these tuned-impedances by such names as "wave trap," "filter," "rejector" or "choke coil" we confuse matters needlessly. It is like calling a dime "ten cents," "one-tenth of a dollar," "two nickels," "two-fifths of a quarter" and so on; it is still a dime and retains the purchasing power of a dime. So too, our wave traps, filters, choke coils, condenser tuned circuits, variometer tuned circuits, etc., are all tuned-impedances and possess the characteristics of tuned impedances. So we can say that C is equal to D is equal to E is equal to F is equal to G.

This is point number one.

The Second Point

The draftsman, limited to sight alone, represents a three-element radio vacuum tube as shown at H. A more correct representation is shown at J. Here r represents the resistance of the filament-plate electronic path. This resistance is under direct control of the grid voltage as indicated by the arrow attached to the grid. The phantom condenser c is shown to indicate that there is no actual connection between the grid and the plate-filament circuits.

The electronic flow represented by the resistance r is secured when the filament is heated, as by the battery A in figure H, and maintained at a negative voltage with respect to the plate through use of battery B. For the sake of simplicity these batteries are omitted in many of the diagrams to follow.

When the voltage of the grid varies —or fluctuates or alternates—the value of the resistance r also varies and this produces a variation of current in the plate circuit. Thus even though the plate battery is a constant voltage device the current through the plate circuit, normally of a steady or constant value, may be made to vary merely by varying the voltage of the grid with respect to the filament. In other words the initial steady current in the plate circuit may be converted into a varying

(*Turn to page 60*)

MR. Meagher's article in the November issue of "Wireless Age," entitled "One Tube Circuits," introduced the comparative method of analysis to show the difference and similarity of certain receiver circuits and thus establish the correct relationship. His ability to condense and classify according to the electrical principles involved, simplified the study of circuits for "Wireless Age" readers to such an extent that we were urged to have him do this article on transmitting circuits.

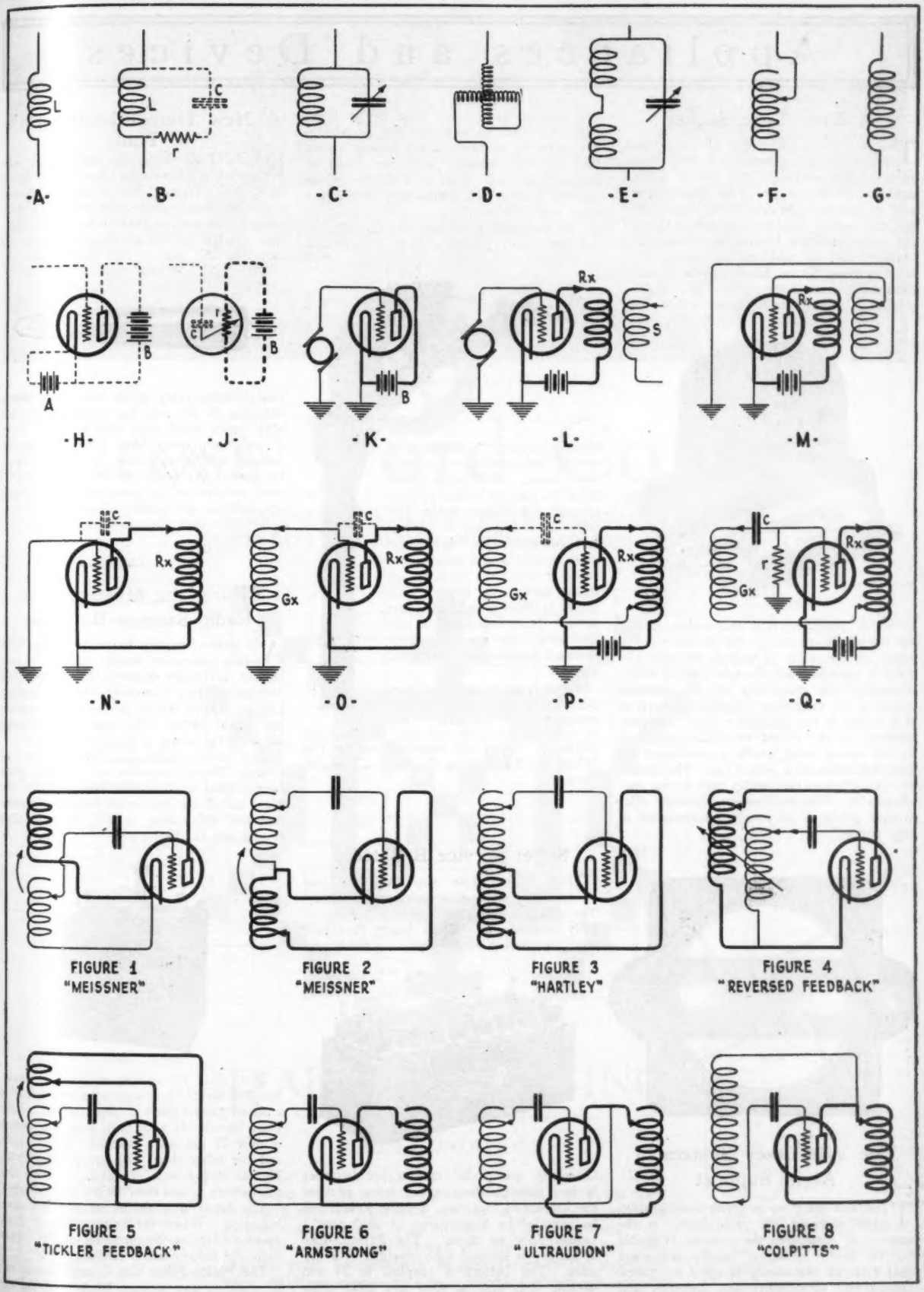


FIGURE 1
"MEISSNER"

FIGURE 2
"MEISSNER"

FIGURE 3
"HARTLEY"

FIGURE 4
"REVERSED FEEDBACK"

FIGURE 5
"TICKLER FEEDBACK"

FIGURE 6
"ARMSTRONG"

FIGURE 7
"ULTRAUDION"

FIGURE 8
"COLPITTS"

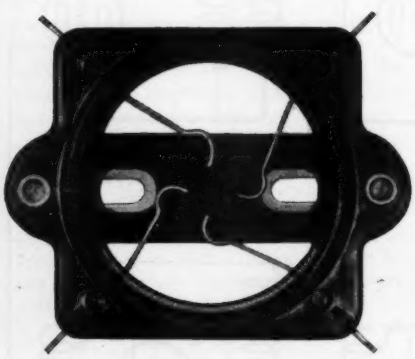
Circuit diagrams of the various transmitting sets discussed by Mr. Meagher

Appliances and Devices

A New Type Socket

THE Colin B. Kennedy Co. announces a new flexible cushioned non-microphonic vacuum tube socket. This socket will be used in sets manufactured by this company and it will also be placed on the market for the use of amateur builders. One of the most important features is the mounting bracket used to take up vibration. This bracket takes up no more horizontal space than the bottom of the socket. It is held in place by two aluminum rivets which have

extended heads so that the socket cannot be forced down enough to damage it. A piece of insulation is placed between the flexible mounting and the tube contact which eliminates the possibility of the contacts touching the mounting. Another feature of this socket is the connection tabs. All connections to the socket terminals are made to the prong itself which is continued out into the form of a solder lug. The socket is very efficient electrically and strong mechanically. The well-known Kennedy side-wiping prong is of course incorporated in this socket.

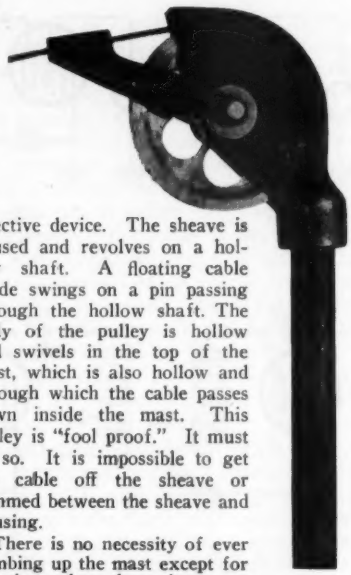


The Whittlesey System of Aerial Support

THE last thing to be given consideration when entering the radio game is the manner of supporting the antenna. It should be the first. Hence it usually transpires that after all the money is spent for tubes, condensers, variometers and batteries and other appurtenances it is necessary to fasten the antenna to a tree, chimney or some high place not suitable for the purpose.

Flag poles, unstandardized, seldom higher than 35 feet, bending with the strain of the antenna and swaying with the winds causing fadings and variations, were found most unsatisfactory.

This necessity gave birth to the idea of our mast-head pulley, a most simple and



effective device. The sheave is housed and revolves on a hollow shaft. A floating cable guide swings on a pin passing through the hollow shaft. The body of the pulley is hollow and swivels in the top of the mast, which is also hollow and through which the cable passes down inside the mast. This pulley is "fool proof." It must be so. It is impossible to get the cable off the sheave or jammed between the sheave and housing.

There is no necessity of ever climbing up the mast except for painting; then the painter can be raised by the cable and reel. He "uses the elevator." These are manufactured by The Whittlesey Engineering Company, Cleveland, Ohio.

Super Service B Battery

THE Prest-O-Lite Co. Inc. has just brought out a new storage B battery. The details of construction have been carefully worked out. Extra heavy jars held apart by spacing panels rest on a thick acid

absorbing pad. In case a jar becomes broken through dropping or being crushed the owner of this new B battery will not be troubled by a discharge of acid over a valued floor or carpet. The Prest-O-Lite B battery is shipped fully charged in a dry state. The battery is supplied in 24 and 48-volt sizes and in 4500 and 2500 milliampere hour capacity for each.

A New Home Constructor's Tool

RECENTLY there has appeared on the market a remarkably novel and useful radio tool. It combines in one instrument a bus bar bender, an eyelet shaper, a wire stripper, an awl, a reamer and a countersink. It has proved to be a most practical tool for the kit of the radio fan. In

straightening sharp bends made with pliers, breaking of the bus bar often occurs, but with bends made with this tool they have a uniform radius that permits repeated bending and straightening in the same spot. In general, practically all bus bar and panel work entailed in the construction of a radio set can be performed naturally and expeditiously with the assistance of this jack of all tools.

Lifting the Mystery from Radio Storage Batteries

AS part of a plan to make storage battery operation easier and more convenient for radio owners, the Philadelphia Storage Battery Company has developed a Charge Tester which permanently replaces one of the battery filler caps and eliminates all need for using a sloppy hydrometer.

This tester—called the Philco Filler Cap Charge Tester—consists of a small glass barrel fitted into a filler cap. Within the glass barrel are two small balls of different densities which float or sink as the battery is charged or discharged.

Electrolyte for testing purposes is drawn into the barrel by compressing and releasing a small rubber bulb in the top end of the glass barrel. If both balls float the battery is over 75 per cent. charged. If one sinks and the other floats the battery is between 75 and 30-per cent. charged. If both sink the battery is less than 30 per cent. charged.

The tester also serves as a water level indicator. When the tester fails to draw up electrolyte on compression of the rubber bulb, the battery needs refilling.

The Philco Filler Cap Charge Tester can be used on any storage battery having the bayonet type of filler caps.

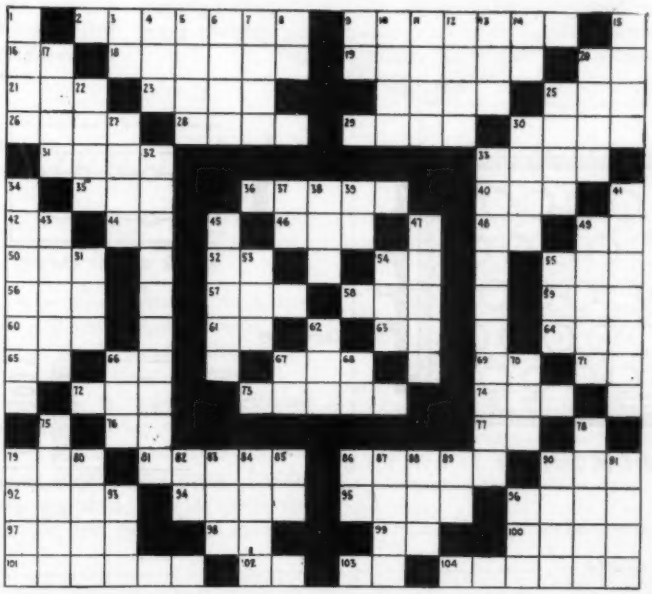
Solving crosswords by radio

Cross Word Contest

One-year subscriptions will be awarded to the first 100 solvers of this easy acrostic

HORIZONTAL

2—What live batteries contain.
9—Type of battery.
15—Radio operators' signal for "Go ahead."
16—What "TRs" were originally called.
18—Neither masculine nor feminine.
19—An exclusive right.
20—A professional degree.
21—Unit of resistance.
23—Presently.
24—Musical pipe.
25—A helpful hint.
26—Hurt.
28—Send forth.
29—Connection across grid circuit.
30—Short term for college society.
31—Apparatus.
33—Necessary implement in building a set.
35—Da dit, dit dit, dit.
36—Front of radio set.
40—Dit, dit da dit, da.
42—Ourselves.
44—Place of the seal (legal abbrev.)
46—"The ambulance call of the sea."
48—Definite article (French).
49—Elder (abbrev.).
50—Reply prepaid radiograms.
52—Exclamation.
54—Dit da, da da da.
55—A detector.
56—A knock.
57—Number.
58—Nothing.
59—Personal pronoun.
60—Period of time.
61—Conjunction.
63—Radio code for "Right."
64—What we do to live.
65—Point on compass.
66—Note of musical scale.
67—Electrical term.
69—Exclamation.
71—Southern state (abbreviation).
72—Metallic element.
73—Elementary substance.
74—A favorite.
75—Radio signal for "OK."
76—Radiograms calling for repetition.
77—His Majesty (abbreviation).
79—An animal.
81—Straight.
86—A telegraph instrument.
90—Call for assistance.
92—Prepare for publication.
94—One thing.
95—One inside every Radiotron.
96—Used profusely in wireless.
97—Pleasing.
98—Da dit dit, da.
99—Pronoun.
100—Let it stand.
101—Remembrances.
102—Printer's measure.
103—Preposition.
104—Admittance.



VERTICAL

1—Type of aerial.
3—Preposition.
4—Grassy field.
5—What you must do for "DX."
6—Smallest particle.
7—Da da dit, dit, da dit, dit dit.
8—A suffix.
9—Southern Pacific (abbreviation).
10—Allowance for waste.
11—Da da da, da, dit, dit da.
12—Emit vapor.
13—Conjunction.
14—"Get" (Radio code).
15—Southern California broadcast station.
17—Wooly hair.
20—At least one on face of your receiver.
22—Manner.
25—Gait of a horse.
27—Metal pin.
30—The golfer's call to those ahead.
32—That which retards flow of current in your set.
33—Art of communication.
34—Needed to light tubes.
36—Radio signal for paid radiogram.
37—Radio signal for "Wait."
38—Negative.
39—Used to form plural of some nouns.
41—Type of radio detector.
43—Extra Radiotron not in use.
45—Unit of transmitting set.
47—What the voltmeter registers.
49—A close watch or guard.
51—Watering place.
53—Personal pronoun.
54—A good Radiotron contains none.
55—Personal pronoun.
62—The letter "E" in radio.
64—Adapt.
67—That is.
68—Western continent.
70—To shut in.
75—Greatest wonder of the age.
78—Center of transformer (Pl.).
79—Suffix denoting result.
80—Notch.
82—"Are you?" (Radio code.)
83—Conclusion.
84—To quote.
85—Radio operator's code for "That".
86—Royal Guard (abbreviation).
87—The Land of Shamrocks.
88—What tube did when current was turned on.
89—Item in newspaper (abbrev.).
90—Location.
91—Radio equipment (Pl.).
93—Small mound of earth.
96—Famous marine coastal radio station.

RADIO CROSSING

Composed by *Helen F. Dittus*

PRIZE CONDITIONS

A year's subscription to WIRELESS AGE—The Radio Magazine will be awarded to each of the first (post date to determine) 100 persons sending in the correct solution to this comparatively easy acrostic—Contest closes Feb. 25—The solution will appear in March WIRELESS AGE and the prize winners will be announced in the April issue. Address replies to Cross Word Contest, WIRELESS AGE—326 Broadway, New York City.

A Home-Made Storage Battery

By J. W. Conzelman, M.E.

THERE comes a time in the experience of every radio fan with his set when the question of a better B-battery is paramount. If the average one of us were to trace our radio development we would find that tuning coils and condensers supplied our first worries, then suitable detectors followed in quick order and probably the A-battery was the next weak link in the set.

As the radio "bug" adds to the set, a storage A-battery must be used and thus the item is disposed of for a time, at least. You are just about to relax, thinking that all your problems are settled when the dry B-battery starts acting up and the question arises: "Shall I buy two more 45-volt dry batteries, or shall I invest in a storage B-battery?" The first solution offers temporary relief for six or eight months. The second represents an investment that is considerable and it sometimes seems questionable whether or not the extra trouble involved in looking after the storage cells does not offset the advantages gained in the operation of the set.

Why not make a simple, high voltage, small capacity source of power? It sounds easy, and if one follows the scent through the various types of primary cells, the voltaic pile, thermo-couple generators and all, he finds that each one offers disadvantages, either due to internal or local action. Friction machines have been tried out and small motor-generator sets, but have been discarded as unsuitable.

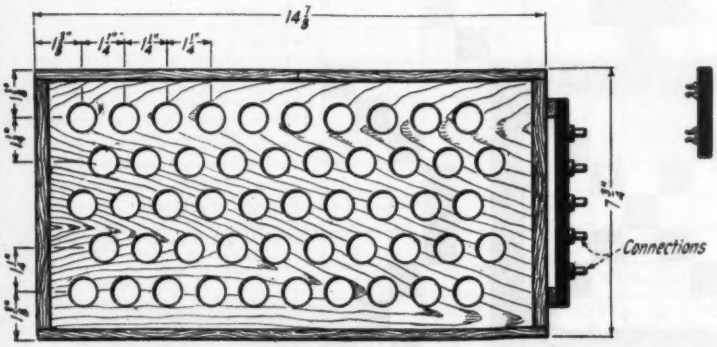
In the storage battery field the non-acid battery was eliminated because it offered no particular advantages over the lead-acid cell, and the unit cell voltage is considerably lower than that of the lead-acid cell. The lead-acid battery gives slightly better than two volts per cell and anyone familiar with regular storage batteries for automobile work, or for filament lighting, knows how to keep the cells in good operating condition.

To make the lead-acid cell there is required two lead plates and a dilute solution of sulphuric acid. If the lead peroxide plate and a plain lead plate are put into a dilute sulphuric acid solution a cell is formed with the peroxide plate at the higher potential. As the cell discharges, both plates are converted into lead sulphate ($PbSO_4$) at the expense of the acid radical in the sulphuric acid solution (H_2SO_4). The action reversible and lead peroxide is reformed on the positive plate with pure spongy lead on the negative upon charging. The reactions are very complicated in nature, but the results may be expressed thus:

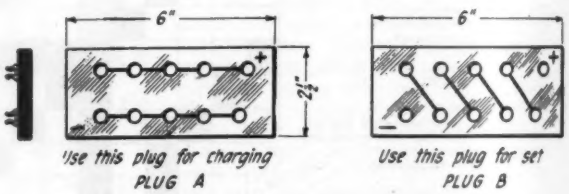
Equation expressing action during discharging $PbO_2 + H_2SO_4 — PbSO_4 + H_2O + O$ at the + plate and $Pb + H_2SO_4 — PbSO_4 + {}_2H$ at the negative plate.

Since the reactions are reversible, reading the equations from right to left shows the reactions during charging conditions.

(Turn to page 62)



Plan showing arrangement of test tubes



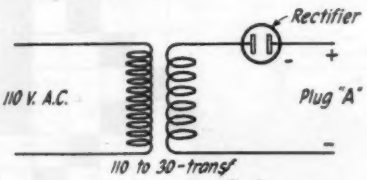
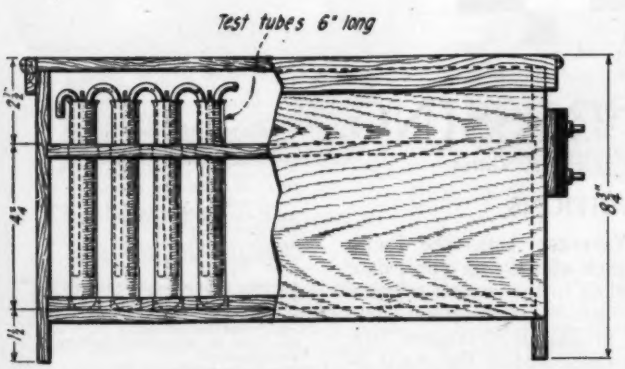
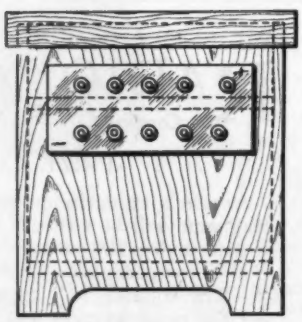


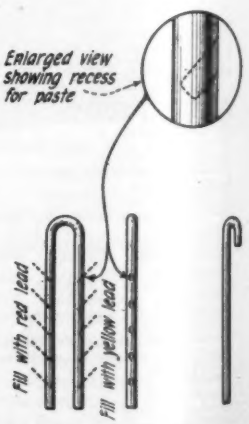
FIG. 3



Side cut away to show cells



End View



Electrodes-made of ¼" lead wire

FIG. 1 FIG. 2

Dry "B" Batteries are an economical, dependable and convenient source of plate current!

No. 770. 45-volt extra large vertical. For heavy duty only. The ideal "B" Battery for use on multi-tube sets. Price $4.75.

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The final tests showed more electricity, more battery service, greater Eveready satisfaction without increasing battery sizes *and with a substantial reduction in price.* "B" Battery operating costs, using the new Evereadys, in most cases show a reduction of at least one-half.

There is an Eveready Radio Battery for every radio use.

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DEEPER even than the circuit diagram—chiefly, indeed, in the *audio transformer.*

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The price is nine dollars

Rauland-Lyric

AN

ALL-AMERICAN

TRADE MARK

TRANSFORMER

The Choice of Noted Music Critics

One Tube Transmitters

(*Continued from page* 55)

or fluctuating current of a rate dependent upon the rate of the grid voltage alternations.

The voltage of the grid may be varied or excited in a number of ways. At K an alternating voltage generator is used for this purpose. If the voltage of the generator alternates 60 times a second, the plate current will also fluctuate 60 times a second, as explained above. Now if a tuned-impedance Rx is included in the plate circuit as shown in figure L, a varying voltage will be "built up" across Rx. Energy may then be extracted from the plate circuit by coupling a circuit S to Rx. If the rate of the plate current fluctuations is sufficiently high, that is, of a radio frequency, this energy may be radiated in the form of electromagnetic waves. We may use a portion of the extracted energy to excite the grid, thus doing away with the necessity for a separate generator for grid excitation. This self-excitation arrangement is shown at M.

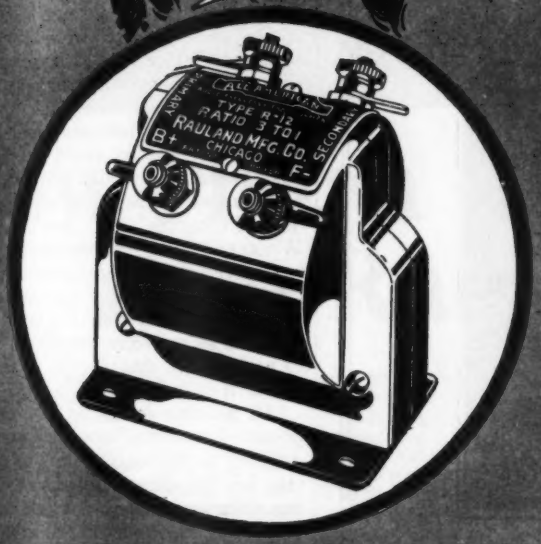
The circuits of K and L utilize separate-excitation of the grid; self-excitation arrangements are shown at M, N, O, P and Q.

Capacitive and inductive coupling or a combination of both may be used between the plate and grid circuits to transfer just sufficient energy from the plate circuit for proper excitation of the grid.

In practice the coupling is always a combination of both methods as the residual capacitive coupling in a so-called inductively coupled arrangement cannot be eliminated entirely; likewise there always remains a certain amount of residual inductive coupling in a so-called capacitively coupled circuit.

Realizing this fact we cannot make even a distinction between the two forms of coupling; and certainly, as coupling is always a combination of both, we cannot say that they are different from each other. We shall, however, continue to refer to coupling as capacitive or inductive depending upon that form which *seems* to predominate. The circuit of figure M is therefore generally termed as inductively coupled self-excitation arrangement.

Figure N represents a circuit in which capacity, c, is used to couple the plate and grid circuits. The coupling c may be the capacity existing between the plate and grid and their leads or it may be a combination of this capacity together with an external capacity intentionally connected between the plate and grid for additional coupling. However, in N the grid is connected directly to ground so even though energy be transmitted through c from the plate to grid, the voltage of the latter will not



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¶ An assurance that, when you try out a hook-up, you can rely on your instruments to give you a *fair test.* ¶ A knowledge that each part has been put to such searching tests that its proper performance, *under any conditions,* is assured. ¶ In short, a conviction that each individual part *will continue* to do its work *year after year.*

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Wound to suit the tube. R-199 $5.00. R-201A $5.00

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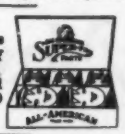
Consisting of three R-110's, one R-120 and one R-130 $26.00



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vary with respect to the filament; in other words the grid will not be excited.

In order that the current variations through the grid circuit will cause the grid voltage to vary with respect to the filament we must include a tuned-impedance Gx in the grid circuit (figure O). Now if energy is transferred through c the resultant current variations through the grid circuit will result in a varying voltage across Gx or between the grid and filament; so the grid will be excited. The voltage across Gx will depend for one thing upon the effective impedance of Gx. This is the real reason for the necessity of an impedance in the grid section of a transmitting circuit. The circuit may be called a capacitively coupled self-excitation arrangement.

In this article we shall omit all reference to the action which is but vaguely and inaccurately described as self-oscillation.

Actually as we have noted before there is no difference between the circuits of M and O. In both the coupling is partly inductive and partly capacitive. So we may say that M equals O.

A third form of grid-plate coupling which evidently is seldom recognized as such is shown at P; here the coupling is due not only to the residual capacitive coupling, but also to conductive coupling. The conductive coupling is secured by making dual use of a portion of Rx. Look carefully at the diagram P. Note that the grid circuit includes Gx and that portion of Rx between the grid tap and the bottom end of Rx. This portion of Rx is common to both the grid and plate circuits. Thus conductive coupling is afforded between them.

Q shows the correct connections for the particular plate arrangement of P which necessitates use of a "stopping" or isolating condenser c in the grid lead. The resistance or grid leak r is necessary to prevent the grid from assuming too high a negative charge because of its position in the stream of negative electrons. The isolating condenser and leak would not be necessary if the plate battery were arranged in a different place than that shown. This is, however, a minor design detail. For the sake of uniformity in the rest of the circuits we indicate grid isolating condensers, but to avoid needless confusion the grid leaks are not shown.

Now we have shown—see "One-Tube Circuits" in the November WIRELESS AGE—the similarity between inductively and conductively coupled circuits; so without further explanation we shall say that P (or Q) equals M; and as we have shown M equal to O we can say that M, O, P and Q are equal to each other.

All of this leads up to the second point. No matter how the grid circuit *appears* to be coupled to the plate circuit for the single purpose of extracting sufficient energy for self-excitation all of the known forms of coupling are equal to each other.

This may seem to be a broad statement, but its accuracy may be checked by reviewing the explanation of the circuits from J to Q, while keeping in

(*Turn to page* 94)

Geared 80 to 1
New Model!
Most Practical Ratio
An ideal operating ratio—not too low nor too high—for infinitely close tuning with perfect ease. A ratio approved by leading radio engineers and proven by the silent endorsement of thousands of users.
NEW ACCURATUNE FEATURE
No Back Lash.
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New Accuratune Micrometer Controls mark an unusual advance in tuning devices! Designed upon a new principle which eliminates all lost motion and back lash. Increasing tuning efficiency over that of any known vernier or tuning device. A truly wonderful instrument—indispensable in DX work. Accuratune Micrometer Controls fit all standard condenser shafts. Mount flush with panel. Easily replace ordinary dials with no set alterations.
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MICROMETER CONTROLS

A Home-Made Storage Battery

(*Continued from page* 58)

HOW TO MAKE THE 100-VOLT BATTERY

GLASS test tubes are recommended for the cell containers. They are cheaper than anything else, are acid resisting, and take up a small amount of space. The main objection to their use is the fact that they are so fragile. ¾" x 6" test tubes of plain glass cost about $2.50 per gross in Chicago. Only 50 tubes will be used, but a few extra should be kept on hand to replace any accidentally broken.

These tubes should be placed in a rack made as shown in figure 1. This arrangement of 10 tubes per row, and 5 rows, makes a rack of convenient shape, and it will be seen that it is convenient to charge the 5 rows in

How I Earn $100.00 a Week as a Radio Expert

A year ago I was mighty blue and discouraged. It seemed to me that I would never be more than a low-paid bank clerk. Of course I had a small increase in salary every now and then, but I knew that pretty soon I would reach my limit and there would be no further advancement for me. What future had I to look forward to? Where would I be in five years? I became restless and discouraged and began to look around for some other opportunity.

It was then that I discovered that the demand is for *trained men*, that the opportunities are all for men who can do some one thing better than anything else. There were wonderful opportunities for men who were experts or specialists—but I was—a clerk. How I regretted then that I hadn't prepared myself for some definite career!

I Wanted to Marry

The thing that made me more restless at that time than anything else was the fact that Marian and I were—that is, we wanted to be married. But we both knew that we couldn't possibly get along on my small salary. If only there was something I could do that would bring me a larger salary!

It was just about the time that everyone became so interesed in radio. Our whole town became radio-mad, and of course what was happening in our town was happening all over the country—all over the world. I managed to save up enough to buy a receiving set and I was never quite so happy as when I was trying to tune in on stations.

The thing fascinated me. Playing with air waves! Bringing melodies and messages out of the sky! I was never so interested in anything before.

Marian was the first to sense the great opportunity. "Why don't you become a radio expert?" she said. "You like it, and I am sure there must be a big demand for men who understand it. It's a new field and there's plenty of room for wide-awake men."

"But—but I'm not trained!" The thought excited me. To be a radio expert! To find my future in this fascinating new field! "I don't know anything about it, Marian" I said. "I wish I did, though."

"Well, why don't you find out about it?" she retorted. "You can't learn about radio just by listening in to the concerts. Why don't you take a course?"

But we found out that most courses were expensive or that they would interfere with my other work. We were about discouraged when I discovered that through the National Radio Institute it is possible to become a radio expert by studying right at home in spare time. I told Marian about it and she was elated. "Send off for information, at once—today!" she exclaimed.

Advances Quickly to $100 a Week

I did, and the following day received an attractive booklet, "Rich Rewards in Radio" telling all about radio opportunities and how to become an expert in any particular phase of the work.

Here was my opportunity at last!

I began to study in all my spare time. It was the most interesting and absorbing study I had ever made. The secret of the radio revealed to me! Day by day I became more skilled and deft until I was able to take apart receiving sets and put them together again as though I were playing with a toy. It was fun! In a month I was able to take a position as lineman at a bigger salary than I was getting at the bank. This was wonderful experience for me, and I kept right on with my studies. It wasn't long before I qualified for a position as radio engineer at a salary of $100.00 a week! That is what I am earning now, though I expect to make more soon. It seems to me almost too good to be true, after all those years as a low-paid clerk in a bank. And Marian, who will soon be my bride, keeps saying, "I told you so!"

As a radio expert I can tell you that there is a tremendous demand for men who can build, sell and install radio sets, who can design, test, repair. Men are needed as operators, engineers and executives, all over the world. The opportunities are limitless, and if you like radio there is no reason why you cannot qualify for one of these positions by studying in your spare time at home as I did.

The National Radio Institute offers an absolutely complete course which prepares you for the Government First Class Commercial License and for the bigger-paying jobs in Radio. The Director, E. R. Haas, will be glad to send you all details of their marvelous new method of practical instruction, including information concerning the Free Employment Service which secures positions for National Radio Institute graduates. Everyone interested should have this information. *It's free,* and this coupon will bring it to you. I advise you to send it off today. Radio is a new and interesting field, and it offers you more money than you probably ever dreamed possible!

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National Radio Institute, Dept. 46DB.
Washington, D. C.

I am interested in radio and would like to find out whether or not I am suited for a radio career. Please send me, without the slightest obligation your interesting free book called "Rich Rewards in Radio." Also full details concerning your special Short Time offer.

Name.....

Address..... Age.....

City..... State.....

multiple, if a 25 or 30 volt B-battery charger is available.

Eleven pounds of ¼" round lead wire will be needed for electrodes. Cut this, after straightening, into forty-five 11½" lengths and ten pieces 7" long. Drill or punch with a sharp tool five small holes in each end of the 11½" lengths, as indicated in figure 2. Punching is recommended, as it is faster and requires less care. Do not go clear through with the hole. These pockets are used to contain the paste used to assist in forming the plates.

At the drug store get about ¼ lb. of red lead C.P. and an equal weight of yellow lead C.P. and make these powders into pastes by mixing with dilute sulphuric acid. Use C.P. acid and mix one part acid with four parts of water to make the pastes.

When the wire is clean use an old knife and press the red lead paste into the holes on one end of each piece and the yellow lead paste into the other end. Lay the hair-pin shaped electrodes aside for at least 24 hours so they will dry slowly. The short pieces are to be treated as above, except that half are made into "+" plates with red lead paste and half into "—" plates with yellow lead paste.

When all have dried out place them in the test tubes, being careful to keep all "+" ends of the plates to one hand and all "—" ends to the opposite hand. Put the single plates in their proper places in the end cells.

To make the electrolyte, buy about a pint and a half of C.P. sulphuric acid, and in a fine stream slowly pour this into a glass or porcelain vessel, containing about three pints of distilled water. Danger! Never pour the water into the acid, because the heat generated will crack the glass vessel and may blow the acid into your eyes and face. The density should be between 1230 and 1240. If below 1230 add more acid slowly as before. If above 1240 add some distilled water very slowly. In either case let it cool again and take another reading.

To keep the electrolyte from creeping paint the tops of the test tubes and the V bend of the lead with molten paraffin or wax.

Connecting up the Battery and Filling

Put all the plates in the tubes and have the red lead plates to the right as shown in figure 1. Secure some lamp cord wire and untwist the two wires, using this to connect up the end cells to the connectors shown at the end of the battery. Solder a wire from each of the top connectors to each of the single "+" plates in the cells at the right end. Solder a wire from each of the bottom connectors to each of the single "—" plates in the cells at the left end and then brush over these soldered connections with molten paraffin.

We are now ready to fill the tubes with the acid solution. Use the hydrometer for this purpose and fill all tubes evenly to a point about one inch from the top.

The battery is now ready for charging. On account of the relatively small area of the plates, a very small charging rate is recommended, not over 2 ampere per cell, or when charging the five rows in parallel, the charging rate should not exceed one ampere.

Charge the battery at this rate for twenty-four hours and it will show one hundred volts, or a little more, across outside terminals. Discharge through a 40-watt 110-volt lamp until the lamp ceases to glow and again charge for twenty-four hours. After repeating this for three or four days, the battery may be used all evening in the radio without a material drop in voltage.

Production of Electric Current

(*Continued from page* 49)

verized manganese dioxide mixed with sal-ammoniac and carbon which is rammed around the carbon rod. The container is filled almost to the top with this compound and the top is sealed with asphalt.

The voltage obtained from a dry cell varies between 1 and 2 volts depending on the type of cell. The standard cell in common use is one

"In September you advertised a one mfd. By-Pass Condenser to be attached across the "B" battery. As I had three sets of "B" batteries (detector, amplifier, and power amplifier) I purchased and installed three of them. They 'did the work' magnificently."

"They did the work!"

This message came from one pleased radio fan—from just one radio fan—but the experience of many others is identical.

And you, too, will find that a Dubilier By-Pass Condenser in your set will eliminate noises—purify reception—and do the work magnificently!

Dubilier

CONDENSER AND RADIO CORPORATION

"Quality Goods for Quality Readers"

Music Master Gives Life to Radio Voices

WORLD fame comes to singers through a mysterious something in the voice—a personal quality that grips the hearers and holds them in a spell of delight.

When voices with delicate modulations and elusive sweetness of tone are broadcast, only a master instrument can reproduce them faithfully. Such an instrument is Music Master.

Two celebrated opera stars sing the Duet of the Flowers from Madame Butterfly. Hear the quality of greatness in their voices, as it can be heard only through Music Master.

Radio impulses entering the sensitive precision instrument in the base are translated into sound waves, undistorted and faithful to the original voice or instrument. In the tapered tone chamber of cast aluminum these sound waves grow clear and bell-like and, finally, the full, mature tones pour forth in rich resonance through the Music Master amplifying bell of natural wood.

Music Master is a musical instrument—*the musical instrument of radio.* Hear it at your dealer's; or, better still, have one sent to your home to prove with your own set.

Dealers Everywhere

Music Master Corporation

Makers and Distributors of High-Grade Radio Apparatus

10th and Cherry Streets

Chicago PHILADELPHIA Pittsburgh

Music Master
RADIO REPRODUCER

Connect MUSIC MASTER *in place of headphones.*

No batteries required.

No adjustments.

MODEL VI 14 inch bell	$30
MODEL VII 21 inch bell	$35
MODEL VIII (*Cabinet Type*) with "Full Floating" Wood Horn	$35

having the elements and electrolyte described in the preceding paragraph. The voltage of this cell is 1.5 volts.

This cell is made in a variety of sizes depending upon the service requirement. If it is to supply a relatively large current of ¼ ampere as is required for lighting the filament of a WD-11 dry cell tube, a large type of cell such as the one shown in the photograph is necessary.

Plate or "B" Batteries

The introduction of the present vacuum tube system in radio, necessitating a battery of from 20 to 40 volts for obtaining a source of voltage for the plate of the vacuum tube, has led to the adoption of a very neat and compact unit as a standard, consisting of 15 cells in an adding combination. This unit can be bought in a number of sizes, one of which weighs a little less than a pound. Its arrangement is indicated in the photograph which shows a partial section of one cell of the complete battery. Each cell consists of a zinc container which holds a carbon rod around which is molded the depolarizing mix wrapped in cheese cloth, in a cartridge form. The negative terminal is brought out in the form of a short wire soldered to the outside of the container and the positive wire is brought out from a brass cap pressed on to the top of the carbon rod after the cartridge is placed in the container, the space between is filled with electrolyte in the form of a flour paste and the cell is then sealed with a small amount of asphalt. The 15 cells are assembled in a pasteboard box lined with waterproof material and connected in an adding combination (that is, in series). The space between the cells is filled with sealing material to make the cells moisture-proof and for insulating one cell from the other. The top of the entire unit is again sealed with asphalt making a battery which combines long service with great compactness and small weight. The intermediate size plate battery has a life of over 500 hours in continuous operation in a vacuum tube set using only one UV-201A tube: that is, when supplying a current of .002 ampere (two one-thousandths of an ampere) which is the average plate current required by a tube. Larger size of plate, or "B" batteries as they are commonly called, will give a corresponding increase of life. These batteries are also sold with taps brought out at 16, 18½, 19 and 21 volts as shown in the photograph to give the purchaser a means for a fine adjustment on the voltage applied to the plate. This is necessary when used on a soft detector tube.

The chief disadvantage of dry cells is their depreciation when not in use. This is due to impurities inherent in the zinc element which cause local electrolytic action on the zinc plate, resulting in the wasting away of the zinc. For this reason, cells should never be relied on for periods longer than 12 months after their manufacture even if they were not in use and the purchaser of a new cell should always look on the cover for the date when manufactured.

"Production of Electric Current" will be continued in a future issue of "Wireless Age." The subjects treated will be storage batteries, mechanical devices, generators, motors and motor-generators.

A Letter from a South American Humorist

SENOR EDITOR JEFE of Wireless Age amigo mio, since coming to your pure and holy country as secretario to our venezulean pugilist i read much about white slavery and thought at first that this meant the prohibition that has been depended on your oculars, but the other evening i listened to one of your escaciones difusoras and heard your silver tongued annoncerio, j andrew white, describing the firpo dempsey controversy, and now i know what white slavery is, but yet i cannot understand why white is so willing to suffer it; please enlighten me. jorje clairek.

Radio Panels In Individual Envelopes

Your Assurance of Manufacture Under the Special Spaulding Process

Just the size panel you need—protected against marring and guaranteed by this envelope container to be Spaulding-Bakelite You can safely *put your faith* in panels sold in these envelope containers. They are processed expressly for radio, with the same unlimited facilities which produce all Spaulding fibre products, famous the world over.
A laminated phenolic condensation product that possesses high dielectric properties and great strength; drills, saws, engraves without chipping; retains a beautiful, everlasting lustre.
Write nearest office for descriptive circular.

SPAULDING FIBRE COMPANY, Inc.
Factory—Tonawanda, New York
Branch Offices—Warehouses

484 Broome St., N. Y. C. — 15 Elkins St., Boston
659 W. Lake St., Chicago — 310 E. 4th St., Los Angeles
141 N. 4th St., Phila. — 171 Second St., San Francisco
509 First National Bank Bldg., Milwaukee

Manufacturers

Spaulding - Bakelite panels are available in Black, Mahogany, and Walnut finishes. Prompt shipments assured from Spaulding warehouses conveniently located on the Atlantic and Pacific Coasts and Mid-Continent. Each branch is newly equipped with the machinery for producing Bakelite panels, coils and specialties to manufacturer's order. Our nearest office employs skilled Bakelite Engineers to serve you.

Spaulding - BAKELITE

"Quality Goods for Quality Readers"

THE SYMBOL OF SERVICE

CONTINENTAL

"New York's Leading Radio House"

Sets that satisfy and serve

HUNDREDS of different types of radio receivers are on the market today, some good and some bad. The Crosley Trirdyn 3R3 Special and the Kennedy Model XV everyone knows is good. They have satisfied and served the most discriminating buyers.

The manufacturers of these two sets have given the best possible receiver at the least cost. Sets that will satisfy and serve your customers as these two receivers have been doing are sure never to become dead items in your trade.

Stock these sets and watch your customers buy. There is plenty of national advertising back of them to help you sell. The radio receivers that sell themselves are the ones you make your best profit on.

2090-Q

CONTINENTAL RADIO & ELECTRIC CORPN.

15 Warren Street **New York, U. S. A.**

Federal Factory Facts

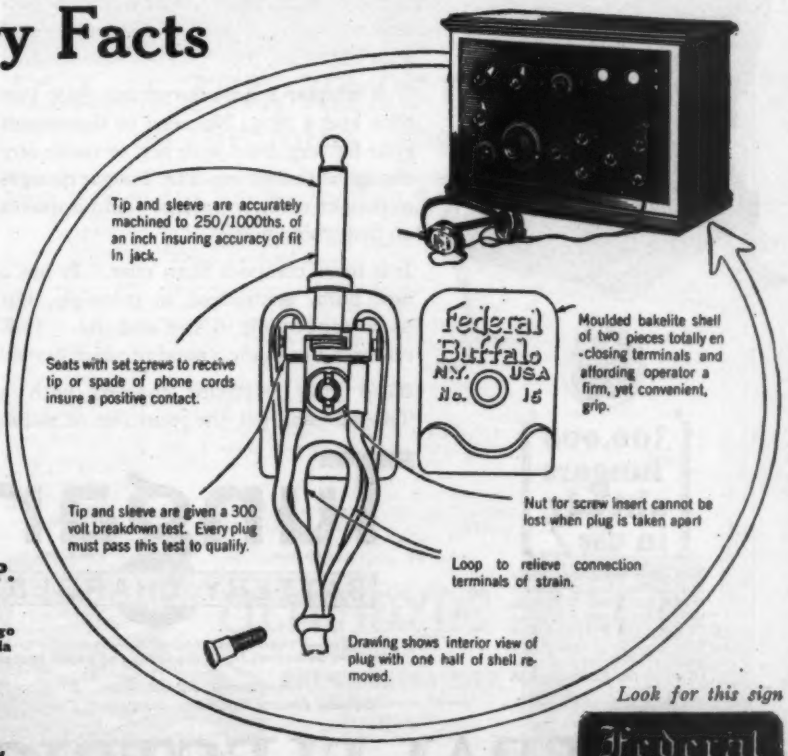
THE plug is the *key* that unlocks the full possibilities of your receiver. No matter what you are getting off the air, you *hear* only what the plug lets through.

Buy a No. 15 Federal Plug for your radio phones or loud speaker if you want to know what your radio set can give you.

Buy a Federal Plug today—also take advantage of the other 130 standard radio parts sold under the same Federal iron-clad performance guarantee.

FEDERAL TELEPHONE MFG. CORP.
Buffalo, N. Y.

Boston New York Philadelphia Pittsburgh Chicago
San Francisco Bridgeburg, Canada


Tip and sleeve are accurately machined to 250/1000ths. of an inch insuring accuracy of fit in jack.
Seats with set screws to receive tip or spade of phone cords insure a positive contact.
Tip and sleeve are given a 300 volt breakdown test. Every plug must pass this test to qualify.
Federal
Buffalo
N.Y. USA
No. 15
Moulded bakelite shell of two pieces totally enclosing terminals and affording operator a firm, yet convenient, grip.
Nut for screw insert cannot be lost when plug is taken apart
Loop to relieve connection terminals of strain.
Drawing shows interior view of plug with one half of shell removed.

Look for this sign

Federal

Federal Standard RADIO Products

Loud Speakers

(*Continued from page 43*)

unit is shown in figure 2. The magnetic field is produced by either a strong permanent magnet or by an electric current flowing through coils surrounding soft iron pole pieces. It is desired, of course, to secure a strong magnetic field in which the moving coil is placed. The signal current flows through the moving coil. If the magnet were constructed as in figure 3, then the magnetism would flow through the coil at U, where the current is, say, flowing up, and would flow through the coil at D where the signal current is flowing down. The U-side of the coil would tend to move out and the D-side would move in as shown by the arrows. The two forces tending to move the coil would balance each other and no motion would result.

In the construction shown in figure 2, however, the direction of magnetism on the D-side is reversed from that shown in figure 3. Consequently both portions of the coil are forced to move together and thus cause the diaphragm to vibrate in unison with the signal current.

In some makes of loud speakers of the moving coil type the diaphragm is small and light and is intended or constructed for use with a horn. On the other hand, some loud speakers have large diaphragms, either of plane or of conical shapes, to which the moving coil is attached. Figure 4 is one of this type. An example of this type is the French "Gaumont" loud speaker. A greatly improved model of this moving coil type with a vibrating cone has recently been developed. This new loud speaker and another one which has been developed recently are without any question far superior to any loud speakers for home use which have yet appeared and are likely to appear during the next few years. I am sure that all of my readers and many of those who have not followed this series of articles will be anxious to learn of these new developments. A description of these new loud speakers, however, together with a discussion of their performance are reserved for a later article.

Another loud speaker has recently appeared in Germany. It is also of the moving coil type, but the coil happens to be a single strip of electric conductor. A sketch of it is shown in figure 5a and 5b. The electro-magnetic system may be considered as either the right or left hand half of figure 2. In other words, there is nothing new insofar as the general principles are concerned. It is similar to the Hewlett induction type of loud speaker in that the sound waves are set up by the vibrating member in which the signal current flows. Here, however, the vibrating member is a strip of foil, whereas, the vibrating member in the Hewlett loud speaker is a diaphragm.

As shown in figure 5a, there is a strong permanent magnet with the north and south poles in the relative position indicated in the sketch. The very light and thin strip of metal, M, carries the signal current which oscillates up and down in the strip. When the current flows up the strip moves back and when the current flows down the strip moves forward. Thus the vibrations of the strip are in unison with the signal current and sound waves are set up by these vibrations.

As we have explained in one of our earlier papers on sound, it is impossible to obtain much sound from a small vibrating object. Witness the sound given off from a stretched rubber band or from a stretched wire. When, however, the rubber band or wire is attached to a sounding box, like a violin body, or a sounding board, like that of a piano, then these small vibrations set up vibrations in a large body of air and cause intense sound to be radiated.

Consequently, we cannot hope to get much sound from a small moving strip without in some way setting up vibrations in a large body of air. In this German loud speaker, this is accomplished not by attaching the strip to a sounding board but by placing it in a small space and closing off the sound

A new Tungar!

The *new* Tungar does all the old Tungar did—and more. It will charge both radio A and B batteries, with no change except slipping the wire from one terminal to another. It charges 2, 4 or 6 volt A batteries—24 to 96 volt B batteries—and auto batteries, too.

It is simpler than ever to use. Just two clips and a plug. No need to disconnect your battery from your set, or make any change in the wiring. The Tungar charges overnight while you sleep. And it makes no disturbing noise.

It is more compact than ever. It has a new bulb, unchanged in principle, but more convenient in size and use. G-E research has made a good product better!

Keep your batteries charged with a Tungar—and get the most out of radio.

300,000 Tungars already in use!

The new Tungar charges both radio A and B batteries, and auto batteries, too. Two ampere size (East of the Rockies) $18

The Tungar is also available in five ampere size (East of the Rockies). $28

60 cycles—110 volts

Tungar
REG. U. S. PAT. OFF.
BATTERY CHARGER

Tungar—a registered trademark—is found only on the genuine. Look for it on the name plate.

Merchandise Department
General Electric Company, Bridgeport, Conn.

GENERAL ELECTRIC

"Quality Goods for Quality Readers"

exit to the rear. In a small space of this sort the vibrating strip of aluminum foil can produce relatively large pressure changes in the air and these large pressure variations set up vibrations of the whole volume of air in the horn cavity attached to the chamber surrounding the strip. In this way we are able to produce aerial vibrations in a large volume of air and set up strong sound waves. It is not necessary at all to have a large sounding board or box to get strong or intense sounds. It is only necessary to secure vibrations of a large volume of air to get intense sounds, and this can be accomplished in a number of different ways.

These remarks lead us easily and without any interruption to the question of the actual production of sound by the loud speaker unit and the radiation of this sound energy into the surrounding space. This introduces us to the purpose and action of the loud speaker horn and of the large cones, etc., used on loud speakers without horns. What are these for? How do they act? How large should they be? What should they be made of? How much can be accomplished with them? What are their limitations? etc., etc. These are some of the important questions to be solved by the scientists and designing engineers. These questions are not only of importance to the specialists and have to be solved by them, but they are of considerable importance to the public who make a decision as to the performance of the hundred and one loud speakers on the market. Every person who buys a loud speaker should be able to select one with some degree of intelligence just as he or she exercises in purchases of other articles.

In our next paper we shall begin the discussion of some new phases of loud speaker work.

Some interesting photographs of the laboratory set-ups are included with this article. They indicate the great variety and complexity of apparatus which is required for our electro-acoustic experimental work.

Schools of Housewifery

(*Continued from page* 38)

one-half of the average class room period, but it is believed that 20 minutes is quite sufficient to maintain interest in a course conducted via radio. Each lecture will be a complete unit in itself, so that mothers who miss some of these lectures unavoidably, will not be thrown out of gear with the entire course. No certificates are being granted for these courses, although this may be a later development.

New York University has also inaugurated an "Air College" which will include service to women. This is broadcast through WJZ. At present these subjects are cultural, but subjects of special interest to women will likely be taken up as this development proceeds.

At WGY, 380 meters, the General Electric Station at Schenectady, N. Y., there is also being operated a very extensive series of talks relating to home topics. An hour on Monday, Tuesday, Thursday and Friday afternoons is given up especially to women and a unique feature of this station's work is that music is interspersed between the talks to women of special home interest. The material broadcast includes a complete range of household management, and in addition interior decorating, fashions, needlework, etiquette, politics, moral education of children, mental advance of children, home nursing, biographies of famous women, etc. This work is in charge of Miss Rosemary Cramb.

It will be seen from the details given herewith concerning the activities for women at various broadcasting stations, that we are beginning to have throughout the country a broadcasting service to which any woman with a radio set located anywhere throughout the country may listen and become better informed. It has been the criticism of American cooks for many years that they have an exceedingly narrow range of information; in fact very hard words are often said about American cooking in various parts of the country. I have myself gone on record as saying that the frying pan appears to

Graph showing how the regenerative effect in the Model L-2 Ultradyne increases as the strength of the received signal decreases.
Why the ULTRADYNE Gets Distance on the Loud Speaker!
Ultradyne Kit
Consists of one low loss Tuning Coil, one low loss Oscillator Coil, one special low loss Coupler, one type "A" Ultraformer, three type "B" Ultraformers, four matched Grid Condensers The Ultraformers are new improved long wave frequency transformers, especially designed by R. E. Lacault, Consulting Engineer of this Company and Inventor of the Ultradyne. To protect the public, Mr. Lacault's personal monogram seal (R. E. L.) is placed on all genuine Ultraformers. Ultraformers are guaranteed so long as this seal remains unbroken.
$30.00
Unlike other Super-radio receivers, the Ultradyne, with its exclusive use of the "Modulation System" and special application of regeneration, is capable of detecting and regenerating the faintest signal, making it audible on the loud speaker.
The regenerative effect in the Ultradyne increases as the strength of the signal decreases, until the signal becomes so weak that no amount of amplification will make it audible.
A radical advance in radio engineering and the latest development of R. E. Lacault, E.E., A.M.I.R.E. Chief Engineer of this Company and formerly Radio Research Engineer with the French Signal Corps Research Laboratories.
You will marvel at the unusual selectivity, sensitivity and range of this new Model L-2 Ultradyne.
Write for descriptive circular.
How to Build and Operate the ULTRADYNE
Model L-2
Send for the 32 page book giving latest authentic information on drilling, wiring, assembling and tuning the Model L-2 Ultradyne Receiver.
50c.
ULTRADYNE
MODEL L-2
PHENIX RADIO CORP.
3-5 Beekman Street
New York City

be the American woman's national emblem. It has been a crime in education that we have persistently and foolishly taught women non-essentials and neglected essentials; ignoring the concrete fact that women almost never can escape the responsibility of home making, whether rich or poor. Some of our richer homes are quite as badly managed, and rich men's families as poorly fed as any of the poorer classes. There seems to have been no tradition at work in America or any tendency toward widespread education to lift up the American woman's standards of knowledge and skill in cooking and home management. I am tremendously interested in radio for this reason, since it makes as free as air education of a very high order given by very competent people on many phases of the woman's technical job in the home.

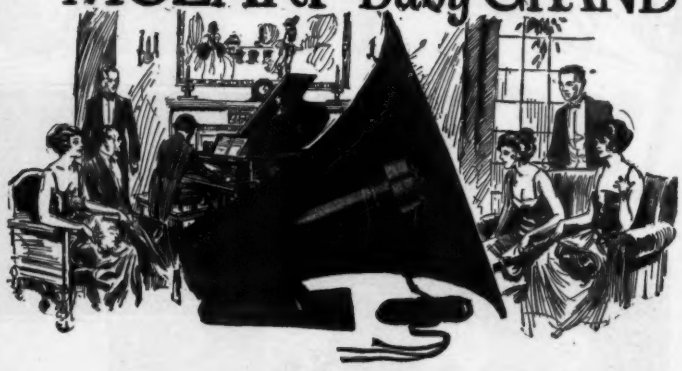
I have lectured throughout the United States in small towns and rural country, and know pretty well the conditions which obtain. They are appalling. Not only have we millions of peasant types from foreign countries whose simple native food standards have been exchanged for much poorer standards here; but we have vast numbers of native American stock, whose household and cooking standards have not risen much in 100 years, and to be frank, have actually declined, due to conditions. They eat indigestible food, they do not eat vegetables and do not know how to cook them; they stuff themselves—in the south especially—with fatty, starchy food until rickets and the hookworm get them; they know little of hygiene or nutrition for children, and they are actually a century behind the men of their family in knowledge of the tools and skill of their craft. You will find tractors on some of these farms, but no washing machine or other modern house tool. The farmer will know modern hog-breeding facts, and actually feed his pigs balanced rations; but his wife feeds her children as stupidly—often as fatally—as if such a thing as a balanced ration had never been heard of. The farmer's pigs thrive while his children die, or go through life with physical handicaps.

Now, this is not exactly the fault of women. They have had no contacts with knowledge. The United States Department of Agriculture has immense, elaborate machinery for reaching and educating farmers. The granges, institutes and county agents abound in lore for farmers; but lo, the poor farmer's wife has been sunk in isolation and oblivion—"cut off from the front," as someone has phrased it.

Don't mistake: the "stuff" in these women of the small town and the farm is just as good as the stuff in the men.

No wonder that radio stations broadcasting home education are enrolling *grandmothers* as well as young women! At last grandmother—supposed to be contented with only her memories and her knitting—has found a chance to be part of the world of active progress!

The MOZART Baby GRAND



Only Another Proof

No piece of radio apparatus even in its price class is the best, because its maker says so, or, because its dealer says so. It is only the best when everybody else says so as well.

"I want to say that it is the best I have ever heard. I could hear as well as if I had headphones and that is saying much as I am rather "hard of hearing." In fact it was the first concert I ever enjoyed 100% without earphones. Here is to your success."

(Signed) EUGENE A. WINTER, Buffalo, N. Y.

PRICES

Baby Grand Reproducer, with gold plated unit, black and gold crackle or extra heavy coated all black satin finish (approx. 12 inch bell)	$12.00
Baby Grand Reproducer, with gold plated unit, black satin finish (approx. 11 inch bell)	10.00
Electro-magnetic unit (fits almost any horn or phonograph) with cord, nickel plated	4.00
Gold plated	5.00
Mozart Special Headset	6.00

No extra batteries required.

Orders.—If your dealer cannot supply, order direct.

Transportation.—Single shipments, strictly F.O.B., factory. Free on two or more orders for each item.

Guarantee.—One year from date of purchase or money back in ten days.

The MOZART GRAND CO.

Manufacturers of Fine Instruments

NEWARK, N. J. U. S. A.

"Quality Goods for Quality Readers"

Among the Broadcasters

(*Continued from page* 39)

he was in a subway jam and involuntarily lifted his hand to reach for a strap. Worn out by the struggle between these attractions and the stern necessity for regulating the amplifier, at the end of a theatrical event the operators are commonly in a state of collapse and must be carried out to their limousines by sympathetic scene shifters and stage carpenters.

And what a privation it is to be good all the time! Anyone can be good for a while; even the worst people, in fact, are good now and then. But the broadcasting operator, in his vocation, must walk the straight and narrow path every minute, or tomorrow he gets thoroughly raked in all the newspapers and his own family repudiates him. All his errors are public the instant they are made. Let him broadcast faithfully and well for several months, and no one pays much attention to him. His work is taken for granted. Then let one of the thousand links between the artist and the listener snap

for a minute, and the technical staff must run the gauntlet. Nor is that all. The broadcasters are blamed, not only for their actual failures, but for mishaps over which they have no control and of which they are not even aware. A violet ray machine or a leaky high tension line, interfering with reception in some remote backwoods, brings down a shower of denunciation on the technical martyrs whose cause I have the honor to plead. If they were not such patient and public-spirited individuals they would, on some disastrous night, take the bias off the modulator grids, turn the grid control up to the explosion point, pour molasses into the microphones, beat up the announcers, and jump off the towers to their just reward.

It would be impossible, in the time allotted to this discourse, to give a complete list of all the privations to which the broadcast operator falls victim, and, if I continue, I fear that I shall burst into language so strong that my own colleagues will take me away. I have, however, a novel and original plan for remedying the evils of this situation, and averting the catastrophes at which I have hinted. This plan I now take great pleasure in presenting to my readers.

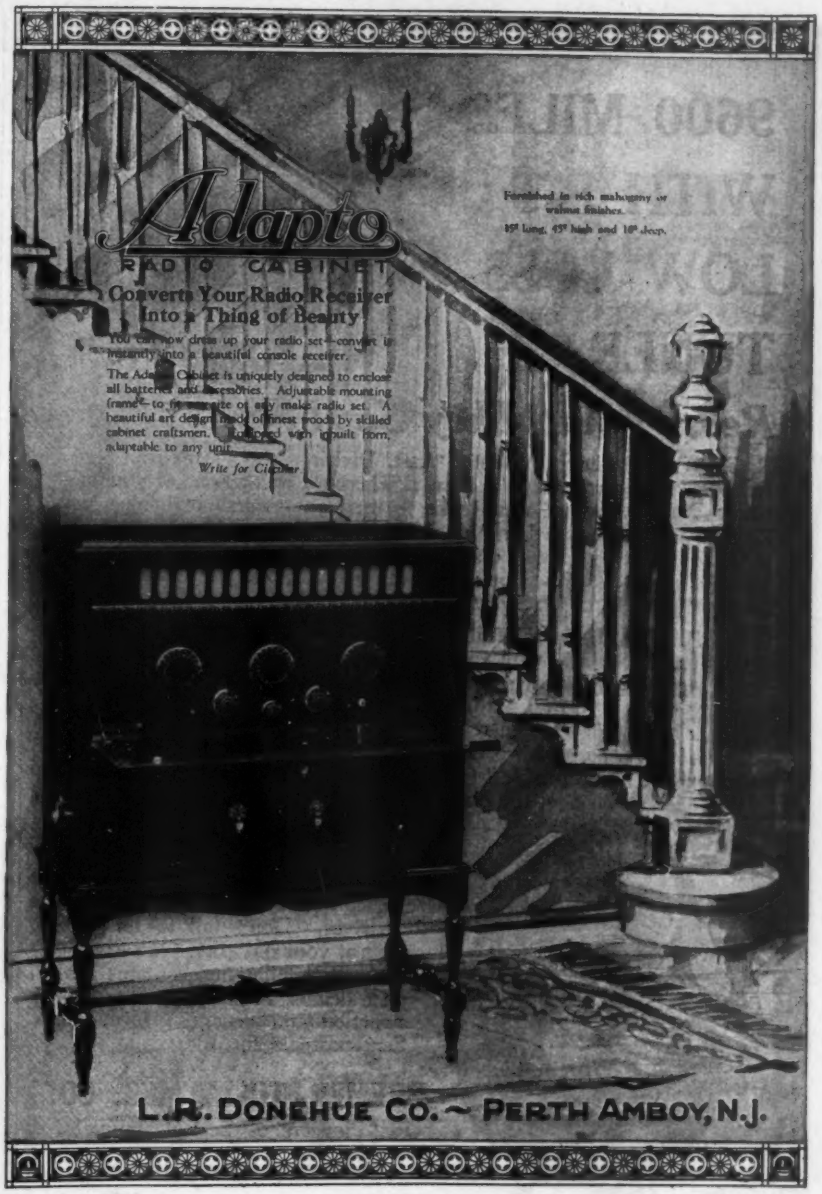
The fundamental trouble, I have become convinced after long and prayerful study, is with the listeners. If there were no listeners it would be easy to run a broadcasting station. Anything could be put out on the air without danger of libel suits, for there would be nobody to hear it. The impresario of the program division would not have to cudgel his brains and impair his health in pursuit of interesting program features, for one event would be just as interesting as another. The engineers would not have to worry about the modulation, for it could sound like ten dog fights for all the harm it would be doing. The engineers could, in facts, leave the sets and play mah jong or blackjack; and no doubt that is just what they would do.

Clearly, therefore, the listeners must be eliminated. But, ladies and gentlemen and good children, do not be alarmed. I am not preaching a crusade for the violent extermination of broadcast listeners. Such a consummation, in fact, would shock and distress me more than anyone else. The solution, on the contrary, is at the transmitting end. My years of engineering experience and sleepless nights devoted to intense thought have brought me the answer. The thing to do is to build a broadcasting station, complete in every detail, but without an aerial. A broadcasting station to be run in vacuum, so to speak, and purely for the pleasure of the operating staff. I now close with an urgent appeal for funds for the immediate erection of such a station. Five million dollars will do nicely. Good night, and thank you kindly.

Modifying the Reinartz

(*Continued from page* 41)

speaking radius is approximately 1,000 miles, under average conditions. Loudspeaking with this hook-up is particularly satisfying, for with good transformers such as the Amertran or Acme there is practically no distortion in the second stage. The only difficulty is that local stations come in so strongly on the second stage that the volume is too great to be handled by a Baldwin


Adapto
RADIO CABINET
Converts Your Radio Receiver Into a Thing of Beauty
You can now dress up your radio set—convert it instantly into a beautiful console receiver.
The Adapto Cabinet is uniquely designed to enclose all batteries and accessories. Adjustable mounting frame to fit opposite or any make radio set. A beautiful art design made of finest woods by skilled cabinet craftsmen. Equipped with built-in top, adaptable to any unit.
Write for Circular
Furnished in rich mahogany or walnut finishes.
L. R. DONEHUE CO. ~ PERTH AMBOY, N.J.

CARTER *"HOLD-TITE"* Jacks

70c.

Carter Jacks are known everywhere for their originality of design and preferred for their quality and fine workmanship.

Made in ten different spring combinations, a style for every circuit.

Any dealer can supply.

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CHICAGO

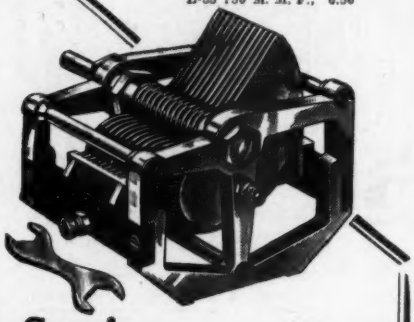
In Canada—Carter Radio Co., Limited—Toronto

"Quality Goods for Quality Readers"

B-T LIFETIME CONDENSER

Type	Price
L- 7 125 M. M. F.,	$4.25
L-11 250 M. M. F.,	4.50
L-23 500 M. M. F.,	5.00
L-35 750 M. M. F.,	6.50

9600 MILES WITH B-T LOW LOSS TUNER

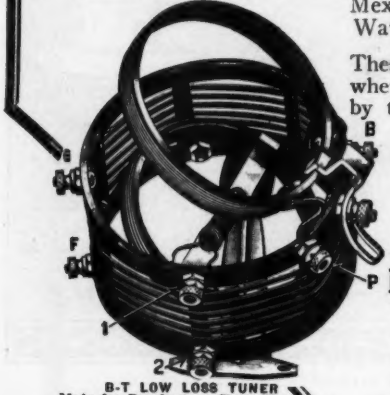


Read What They Say!

Radio 2WR, Arthur G. Wester, Asst. Division Mgr., American Radio Relay League, wrote us as follows: "Having obtained one of your new Short Wave Tuners I would like to mention results obtained. New Zealand 4AA was copied on Nov. 13th steadily from 6:16 to 6:39 A. M. E. S. T. The estimated distance is 9600 miles. Mexican BX was worked from this station on Nov. 15th and not one word was missed. Stations all over the U. S. have been copied."

R. A. Bradley, Technical Editor of Wireless Age, reports that—"The results that I obtained with your Broadcast tuner and transformer have never been equaled by myself nor any of my associates. The adjustable coupling on your Low Loss Tuner is one of the most valuable things that has been added to the regenerative type tuner. For people living in any of the congested broadcasting centers I know of no combination that would be more suitable." (See December Wireless Age, or write us.)

Radio 9ZA, Chicago, Illinois, has received English, French, Dutch and Mexican Stations with one of our Short Wave Tuners.



B-T LOW LOSS TUNER
Made for Broadcast or Short Wave work. Ranges covered with L-11 Condenser:
Type B.....200 to 565.....$5.00
Type SW.... 40 to 150.....$5.00

These letters are typical. Experts everywhere agree that B-T parts are in a class by themselves. Don't fail to see these parts at your dealers! Our 40 page book, Better Tuning, contains complete details, hook-ups, tuning, construction and general information. Sent postpaid for 10c.

BREMER-TULLY MFG. CO.
"Pioneers of Better Tuning"
532 S. Canal Street
Chicago Illinois

14-inch Bell
Polished Pyralin

Aluminum sound column

Burns
A Speaker of Distinctive Lines

All the volume you want with no sacrifice of clearness or naturalness. The full true tones of voice or music are reproduced. Equal to hearing the original. Speaker Unit only supplied for use on phonographs—fits any make.

No. 205B—Polished black flare.....$22.50
No. 205D—Shell pyralin flare..... 25.00
No. 100—Unit for phonograph use..... 10.00

Makers of telephones for 30 years.

Manufactured by
American Electric Company
State and 64th Streets
CHICAGO

"Quality Goods for Quality Readers"

unit. In my opinion a well built three tube set using this circuit leaves nothing to be desired in the way of sensitivity, volume, clarity and ease of tuning, and its selectivity is surpassed only by such sets as the Superdyne and Neutrodyne, and of course, the Super-heterodyne.

In experimenting with this circuit various combinations of apparatus have been used in the different sets, such as different forms of inductance, different types of condenser, different makes of variometer and different values of grid leak and grid condenser. The only general rules to be drawn are that the higher grade the apparatus and the more nearly it approaches the "low loss" condition, the better the set will perform. Very good results have been secured using a spider web coil for the tuning inductance. The type of variometer makes no real difference, although each different variometer gives slightly different control characteristics. The nicest control was obtained using a moulded (Manhattan) variometer, which has a very high inductance. With this variometer an interesting variation in set construction was also possible, in that the instrument was secured to the panel upside down and a binding-post panel made by fastening a small strip of bakelite to the projection intended for a base mounting of the instrument. The variable grid leak was found to possess no advantages over the fixed leak. However, a vernier control over the condenser is essential, either by means of a vernier plate or vernier dial—one method is as good as the other. In no case was shielding found to be necessary, since there is an absolute lack of body capacity when good apparatus is used.

Excellent results have been secured using the 201-A tubes, with which it was noted that 45 volts on the detector tube resulted in appreciably greater volume and selectivity. The UV-200 detector has also given splendid results. No undesirable coupling effects seem to exist between the tuning inductance and the plate variometer, so that the positioning of the apparatus is relatively unimportant.

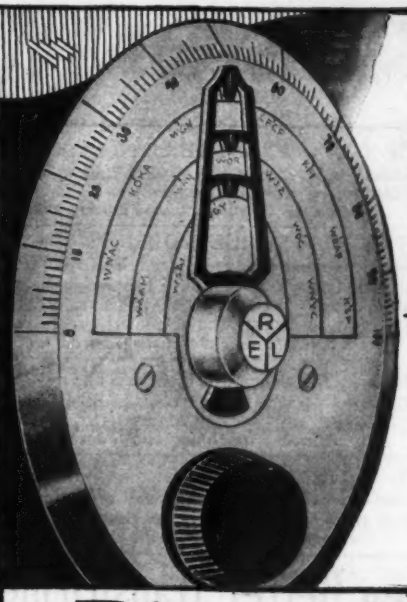
Naturally this set must not be considered a "record breaker" for it is after all only a very good regenerative receiver. Thus, under favorable conditions it has brought the west coast stations into Chicago and it has shown a log of thirty-five distant stations in one night. In August, 1924, a three-tube set of this construction brought in twenty-five distant stations, fifteen on the loud speaker, and it has given loud speaker reception of Davenport at noon, in bright sunlight. The point is that it is one of the simplest and best of the regenerative circuits and may be relied on for the most consistent type of performance.

Low Loss Receiver

(*Continued from page 35*)

nections and greatly simplifies the wiring. The lead running along the top of the low loss tuner terminal strip to the Bradleystat as shown in the accompanying illustrations is the A minus lead and all returns are made to this lead, and it is finally grounded by a strap connection to the ground binding post wherever convenient. In making this connection, run one piece of bus wire from the farthest Bradleystat to the ground terminal on the low loss tuner. Then take all connections which should go to this minus A line, off from this one main lead.

We prefer to use in an audio frequency amplifier single closed circuit jacks for cutting in the phones at various stations. If wired according to the diagram, they work just as well as double circuit jacks and are much easier to connect up. When the phones are plugged in the jack, the transformer of the following stage is automatically disconnected. We always make a practise of connecting the framework of the jack to the positive of the B battery in every instance and likewise the top contact of the jack to the plate of the preceding tube. This provides a standard and it is just as well to make as many things as possible standard in your set. By connecting the jack in this manner you have a ready means of testing your B battery voltage by placing one contact of the voltmeter on the jack and the other on the filament switch. This is a more correct method of testing batteries than by taking a reading directly across the batteries themselves as it indicates exactly what the working voltage of your battery is at the set itself. You may have 45 volts in the B battery under the table, but after passing through some high resistance leads connections and contacts it may be anything from 38 to 40 volts by the time it reaches your tubes. If you stop to realize how many connections the battery current must go through in order to reach your tube, you will exercise more care in making clean-cut connections, soldering where possible, and eliminating all useless resistance. Notice the location of the Bradleyleak fastened to the baseboard of the set near the grid terminal of the detector tube socket. This excellent gridleak is now being supplied with a .00025 mfd. Dubilier Micadon condenser which fits directly across its terminals. This makes the unit complete, for one needs only to use this variable gridleak with a stubborn detector tube in order to appreciate the value of a good variable gridleak. This leak should be turned all the way out, and the tickler rotated until the set goes into oscillation. Now turn the gridleak "in" which decreases its resistance until the set goes into



The Station You Want Is Marked on the Dial

Designed by ROBERT E. LACAULT
Made by HAMMARLUND MFG. CO.,
Expressly for
PHENIX RADIO CORPORATION

Direct Tuning

Designed by R. E. Lacault, E.E., A.M.I.R.E., inventor of the famous Ultradyne circuit. This monogram seal (R. E. L.) is your assurance of Lacault design.

Stop fishing for your favorite station. *Select* the program you want—get it lightning-quick. Replace your old dials with ULTRA-VERNIER Tuning Controls. Then, when you have tuned in a delightful station, pencil-record it on the dial. Never again need you guess or fumble for that station, or bother with wave-lengths. Simply turn the finder to your pencilmark, and you hear it! Should you move—or a station discontinue or wave-lengths change—erase the marks, leaving the dial beautifully clean and new. Thus, you may *now* have all the joy of radio, with none of the discouragements. Moreover, the ULTRA-VERNIER is a single vernier tuning control.

$2.50
At your dealers

Made by the Hammarlund Mfg. Co., your assurance of quality and dependability—produced solely for the Phenix Radio Corporation.

At your dealer; otherwise send purchase price and you will be supplied postpaid.

ULTRA-VERNIER TUNING CONTROL
PHENIX RADIO CORPORATION
3-5 BEEKMAN STREET
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Learn the Code at Home with the Omnigraph

"Just Listen—The Omnigraph will do the teaching"

THE OMNIGRAPH Automatic Transmitter will teach you both the Wireless and Morse Code—right in your own home—quickly, easily and inexpensively. Connected with Buzzer, Buzzer and Phone or Sounder, it will send you unlimited messages, at any speed from 5 to 50 words a minute. THE OMNIGRAPH is not an experiment. For more than 15 years it has been sold all over the world with a money back guarantee. THE OMNIGRAPH is used by several Depts. of the U. S. Govt.—in fact the Dept. of Commerce uses THE OMNIGRAPH to test all applicants applying for a radio license. THE OMNIGRAPH has been successfully adopted by the leading Universities, Colleges and Radio Schools.

Send for FREE Catalog describing three models.
DO IT TODAY.

THE OMNIGRAPH MFG. CO.
16B Hudson St. New York City

If you own a Radio Phone set and don't know the Code—you are missing most of the fun

They say— (*continued from last month*)

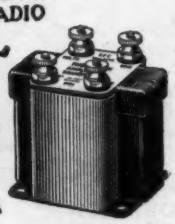
5 THEY SAY OF THE ULTRADYNE L-2:
"Selectivity is so high and amplification so strong that distant stations can be tuned in through local stations and put on the loud speaker."
Ultradyne amplifies with Thordarsons!

6 THEY SAY OF THE PFANSTIEHL MODEL 7:
"People *now* want trouble-proof service and purity of tone. The new Pfanstiehl . . . gives a clear, natural tone at any distance. . . . There is no distortion, however great the amplification. . . . It comes in like velvet. . . . Two stages of audio amplification—low ratio, of course, to give perfect quality, with all the volume desired." *Pfanstiehl amplifies with Thordarsons!*

7 THEY SAY OF THE HOWARD NEUTRODYNE:
"It brings in distant stations distinctly. It has natural tone qualities. It has remarkable volume."
Howard amplifies with Thordarsons!

8 THEY SAY OF THE RADIODYNE:
"When you own a Radiodyne you can hear singers' voices and orchestral harmonics faithfully reproduced thru the loud speaker . . . so clear and distinct that you lose nothing." *Radiodyne amplifies with Thordarsons!*

ZENITH KENNEDY RADIODYNE C.L. THERMIODYNE ULTRADYNE MURDOCK AZARKA Pfanstiehl MICHIGAN Deresnadyne MALONE LEMON MASTER RADIO ROYAL Howard Pathé HARMONY AUDIOLA GLOBE SAAL AND MANY OTHERS



SUPER HET BUILDERS! For the Remler Super - Heterodyne, Radio Magazine and other leading authorities recommend in highest terms the Thordarson 2:1 ratio transformers. Take no others!

When Better Transformers Can Be Bought— They Will Be Thordarsons!

Tone quality! Clear, natural reception! Even volume, over the entire musical range! That is what the public demands today. And is getting in the finer sets—equipped with Thordarsons for *musical* amplification. Leading set makers continually test and compare transformers. They use *more* Thordarsons than all competitive makes combined—which answers the transformer question. If *you* want the best amplification, simply follow their lead: *build or replace with Thordarsons!* All stores can now supply you. Accept no substitutes. If your dealer is sold out, you may order from us by mentioning his name. Interesting bulletins on amplification mailed free. Write.

THORDARSON ELECTRIC MANUFACTURING CO.
Transformer specialists since 1895
WORLD'S OLDEST AND LARGEST EXCLUSIVE TRANSFORMER MAKERS
Chicago, U.S.A.

Unconditionally Guaranteed
THORDARSON Super AMPLIFYING TRANSFORMERS
Standard on the majority of quality sets

TYPES AND PRICES: Thordarson "Super" Audio Frequency Transformers are now to be had in three ratios: 2-1, $5; 3½-1, $4; 6-1, $4.50. Thordarson Power Amplifying Transformers are $13 the pair. Thordarson Interstage Power Amplifying Transformer, $8. Write for latest hook-up bulletins—free!

ZENITH Super-Portable

A six-tube radio set, completely self-contained. Does not need to be opened to operate. Write today for full particulars and name of nearest dealer.

ZENITH RADIO CORPORATION
McCormick Building, Chicago

EMPIRE Oiled Tubing

Real Radio Sets of today—the kind that last long and work best—are insulated with genuine Empire Oiled Tubing.

MICA INSULATOR CO.

68 Church St. New York
542 So. Dearborn St. Chicago
Works: Schenectady, N. Y. 2030-F

"Quality Goods for Quality Readers"

oscillation smoothly without a click and with no hangover. When this is obtained it should be left in the position.

Operation

Many of the fans seem to be scared of a three control regenerative receiver and seem to shun them as something fearful. The addition of one more tuning control—the variable primary should be looked upon as a convenience and a distinct aid in tuning rather than "just one more knob."

If you set this dial at 100, that is with the windings of the primary parallel to the windings of the secondary coil and rotate the variable condenser slowly over the entire scale it will be found that with the average antenna there is a spot somewhere between 200 and 300 meters where the set will not oscillate readily and regeneration is almost impossible. Nine times out of ten this is the fundamental wavelength for your antenna and at this point your antenna system is absorbing too much energy from your tube circuit to permit its action as generator of continuous oscillations. Keep the condenser at this spot and the tickler setting the same and rotate the primary coupling dial slightly and it will be found that the set will now oscillate at the point where it did not, a moment before. Now this is not the only use which the variable coupling has. If it should happen that your receiver tunes broadly which is possible (but hardly probable) with this combination then the rotation of the primary coil 15 or 20 degrees off the parallel will greatly increase the selectivity of your receiver. On a well-designed tuner such as the one used in this receiver, loosening of your antenna coupling will not materially affect the wavelength of the secondary circuit. However, it does to a very slight extent. If you reduce the coupling or rotate the coil away from the parallel it will be found that it is necessary to slightly increase the dial reading on the tuning condenser to compensate. For this reason all three dials should be calibrated for a given station so that you may return to the exact setting.

In conclusion we would like to again bring up the subject of choice of parts. We make a practice of specifying a given part for your guidance in building the featured receiver each month. Many have a wrong idea of what this list is for. It is perfectly possible to build up this receiver using apparatus (other than that specified), in every single instance from the tuner to the panel itself and have it work well providing good material is used, but for the benefit of the many fans who cannot readily recognize efficient apparatus from apparatus which is otherwise, we print a list of materials to be used in building the set.

The Children's Hour

(Continued from page 33)

er of the "Children's Hour" programs is Billy Osborne, a ten-year-old from New Brunswick, New Jersey. His mother calls him "The Boy Outlaw of the New Jersey Woods" for by prowling about in the woods he has learned the bird-calls and songs of "Bob-White," "Whip-poor-will," the "White-throated Sparrow," the "Bob-o-link," and a dozen other birds whose notes he can reproduce with such accuracy that the birds themselves answer him. It is practically impossible to distinguish his voice from the voice of the bird whom he is imitating.

Florence Hines' voice is so beautiful that when she is singing people frequently phone the studio protesting that a grown woman is being introduced as a child. Her voice is the rich, strong soprano of a woman who has been studying for years and as she is only ten years old now one can imagine the future which lies before her. Florence has had the honor of singing before President Coolidge in Washington and when her voice has received the training which is promised her she will probably be singing before the crowned heads of Europe as well.

One might go on almost indefinitely talking about these children. Constance Campbell, a nine-year-old prima donna of Great Neck, Long Island has achieved success on the stage in benefits in which Broadway stars have also appeared. She is a great little character actress and her comics are always received with enthusiasm.

Nathalia Crane has a nation-wide reputation as a poet, for at the age of eleven she already has to her credit a volume entitled, "The Janitor's Boy" which is now in its fourth edition, as well as another volume called, "So and So Verses." She is a favorite at WJZ for she recites her own unique verses for her listeners-in.

But no children's hour could be complete without a real baby and the infant of the Sunday morning entertainment is little Betty Sargent a four-year-old wonder who both sings and recites with the most perfect self-possession. For her the transmitter has none of the terrors which confront her elders who realize its possibilities. She adores Mr. Smith and he adores her.

One might go on almost indefinitely for each Sunday brings new prodigies to the studios. All these that I have mentioned were discovered in the first three months. Besides the entertainment which they give, the "Children's Hour" also includes a reading of part of an editorial and the interpretation of the comics in that day's paper so that the parents may sleep undisturbed and not have little folks clamoring to have the funny pages read to them.

MAGNAVOX Radio

Receiving Set TRF-5 with Reproducer M4 • $125.00

EXPERIENCED radio users have stated that this Magnavox equipment (illustrated below) represents the highest standard of real value and usefulness ever offered in the radio field.

The Magnavox 5-tube circuit is a special development of tuned radio frequency in which a splendid balance of selectivity, range and volume have been attained. The one dial Station Selector eliminates all tuning adjustments; while the Magnavox Reproducer insures sonorous, pleasing tone for all programs.

Magnavox Radio Receiving Sets, Tubes and Reproducers are carried by reliable dealers. Illustrated booklet on request.

THE MAGNAVOX COMPANY
OAKLAND, CALIFORNIA

New York: 350 West 31st Street
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San Francisco: 274 Brannan Street

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ANDRAE In Business Since 1869

MARLE ENGINEERING CO.
"Radio's Best Transformer"
Write for Literature
MARLE ENGINEERING CO.
ORANGE NEW JERSEY

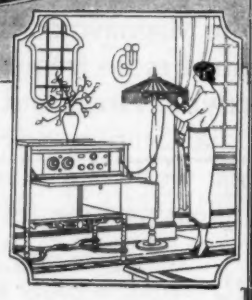
"Quality Goods for Quality Readers"

The Modern "Arabian Nights Entertainment"

Connect the Mu-Rad MA-20 to Any Electric Light Socket and be Entertained without Further Effort.

"'This rug, my master,' said the merchant to the prince. 'will carry you where you will. Simply express the wish and instantly you are transported.'"

—Arabian Nights Entertainment



The New

MU-RAD RECEIVER MA-20

The Last Word in Radio

THE "magic carpet" expressed the medieval idea of the ultimate in swift transportation. The modern conception of the ultimate in radio reception is the new *Mu-Rad Receiver MA-20*. Entertainment from the cities of a continent at your command, simply by turning the dials to certain numbers—always the same. No batteries to wear out or recharge.

NO Antenna or Loop
"A" or "B" Batteries
Battery Charger

Cabinet Model MA-20

The MA-20 can also be purchased in a handsome Adam Brown hand-rubbed finish mahogany cabinet with engraved Formica panel.

Write for Literature and the Name of the Nearest Store Where You Can See the Nu-Rad MA-20

MU-RAD LABORATORIES, INC.
808 FIFTH AVE ASBURY PARK, NEW JERSEY

IF you could make a comparison *capacity test* of our noiseless mica condensers,—as many leading set manufacturers have done,—you likewise would ever after insist on

NEW YORK COIL CO'S.
338 Pearl Street, New York City

Pacific Coast Representatives
MARSHANK SALES COMPANY
926 Insurance Bldg. Los Angeles, Calif.

HERCULES
Aerial Mast

All Steel Construction

Painted black complete with galvanized steel guy wires and masthead pulley. 20' mast $10, 40' mast $25, 60' mast $45. We pay freight. Ideal for receiving or transmitting. Greater range. More satisfactory results. Write for literature and large

FREE BLUEPRINT

S. W. HULL & CO., Dept. D3
2048 E. 79th St. Cleveland, Ohio

When the "Children's Hour" first started it was given in the evening as a bed-time story with such people as Thornton Burgess, himself at the microphone but Mr. Smith's conviction was that this did not meet the needs nor the desires of the children and in fact, when it was discontinued practically no protests were entered. Now the Sunday morning program frequently includes such people as James Swinnerton, the creator of "Little Jimmy" cartoons, and other famous cartoonists, and story-tellers who do their little bit on the same program with the little children.

Anna Diamond, pianist, who, at nine years of age, will give her first recital at Aeolian Hall in February

For the program as a whole Mr. Smith says, "The fact that the program is presented by children is an inspiration in itself to the youngsters who listen-in. For instance: The children hear a young girl of ten years old who possesses a very attractive soprano voice. Any child with a promising voice also wants to improve her voice, to sing just as well as the singer she heard over the radio. One of the greatest difficulties of having a child broadcast is that most of them desire to sing popular songs. They all seem to think that is the best way to test their merits, but it is not the popular song that appeals on Sunday mornings, and the most effective songs are those of the lullaby and other old-fashioned types."

Mr. Smith is putting so much thought on the work of this very unusual broadcasting feature that it will undoubtedly become one of the most valuable hours of any studio. In fact, WJZ has already asked him to double the length of his entertainment.

Child Thespians are presenting plays in the Woodshed Theater over WLS, Chicago, The Woodshed Theater is a mythical playhouse which Ford Rush and Glenn Rowell built in their imagination during the Lullaby Hour Period, doing the job piece by piece until it was announced to the boy and girl radio fans that the Woodshed Theater was ready for the opening performance and that the actors and actresses would be members of the WLS Lullaby Tots club. There soon was a rush to the WLS studio in the Hotel Sherman, and after rehearsals under the direction of Harry Sadler, the first playlet, "Robinson Crusoe's Princess," was produced over the radio. On the evening of November 13th, "Going to School in Mother Gooseland" was the attraction. Since then "Mr. and Mrs. Robin Find a Winter Home," "The Sleeping Beauty," and other playlets have been broadcast from WLS.

Radio Apartments

(*Continued from page 47*)

ing stations, and at any time the tenant may push in a plug and be connected with any one of these three. A fourth apparatus Kerr keeps free for special requests and can "get" any station.

Meanwhile the tenant down in his sitting rooms sits, as I sat, with the best the world has to offer at his elbow. If he wants one of the three local broadcasting stations he puts the plug into that one of the three holes that corresponds and gets his desired program. But he is not limited to these three. Suppose he wants any other station, local or far away, he has only to telephone up to the control operator and tell him, for instance that he wants XYZ—Los Angeles; then push his plug into the fourth hole and in a moment Los Angeles' best orchestra is playing for him.

Possibly you think that to live in such an apartment house, where the radio is considered as much a part of the necessary furniture as the telephone, would be as peaceful as living in the midst of an anti-prohibition meeting, or on the peak of the Tower of Babel. But the renting agent assured me that every apartment is sound-proof.

Or perhaps you would like to dial and fuss with your own radio? You don't like "canned" stuff. Everything is arranged. The family can plug in and listen to the apartment radio and yet not a sound will disturb you as you

This WINDING minimizes distortion

It is patented and known nationally as the famous

HELICAL WINDING

which is different than any other winding used in Transformer construction. This Helical Winding is the reason why

Samson Helical Wound Transformers

on recent trans-Atlantic tests gave conclusive proof of Samson Helical Wound Transformer efficiency by bringing in English stations on loud speaker with only one stage of audio.

Get distance; get volume; get quality of tone; tune out your strongest local station and tune in for any point with a "Super" built with Samson Transformers. Send for information on our new Super-Kit. If your Dealer can't supply, write:

Samson Electric Co.
Mfrs. for over 40 years
Canton Mass.

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Twenty-five Different Engraved Tops

They Don't Lose Their Heads

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use RESISTANCE!
DURHAM
Grid Leaks
75¢
at dealers or postpaid

Variable:—
No. 101—1-10 to 5 megs.—soft tubes.
No. 101A—2 to 10 megs.—hard tubes.
No. 100—1000 to 100,000 ohms by-pass.
Metallized Fixed:—
Over ½ meg., 50c; under, 75c.

DURHAM & CO., Inc., 1936 Market Street, Philadelphia

"Quality Goods for Quality Readers"

Write today for your FREE copy of—

Ward's New Radio Catalogue

THIS advertisement is published to tell you three things that everyone interested in Radio *should know*.

That we believe Ward's is today the greatest Radio store in the world—that it is the real Headquarters for Radio.

Second, that at Ward's you can buy everything in Radio without paying the usual "Radio Profits."

Third, that this big 68-page book—a genuine reference book on Radio—is yours free for the asking.

Our Radio Experts

This Catalogue is a book gotten up by experts. It shows all the best hook-ups, everything in parts and complete sets—so simple that you yourself can easily install them.

And it shows only tested and approved Radio equipment—selected and tested thoroughly by our Experts who are up-to-the-minute in Radio.

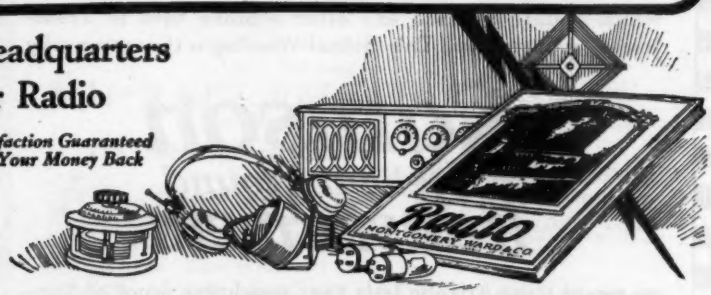
Write for Ward's free 68-page Radio Catalogue and see the low prices.

Our 53 Year Old Policy

Every Radio set we sell is guaranteed to give complete satisfaction. In buying Radio from Ward's you are buying from a house whose reliability is above question. For 53 years we have sold quality goods only. Address our house nearest you. Dept. No. 24-R

Headquarters for Radio

Satisfaction Guaranteed or Your Money Back



ESTABLISHED 1872

Montgomery Ward & Co.

The Oldest Mail Order House is Today the Most Progressive

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You will be satisfied with a "Pacentized" set

THE man who uses Pacent Radio Essentials in building his set has the assurance that he is using the finest parts that engineering skill and trained hands can build.

That this confidence is not misplaced is shown by the fact that over 40 of the leading radio set manufacturers use one or more Pacent Radio Essentials for standard equipment. This shows the leadership that Pacent has attained in the radio parts industry.

Select the parts for the new set you contemplate building from the list given opposite. Get them from your favorite dealer—he carries them or can get them for you.

PACENT ELECTRIC COMPANY, Inc.
91 Seventh Avenue, New York City

Washington Minneapolis Boston San Francisco
Chicago Birmingham Philadelphia St. Louis
Buffalo Jacksonville Detroit

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Radio Essentials
Adapters
Improved Audioformer
Autoplug
Coil Plug
Coil Plug Receptacle
Condensers, Low Loss
Detector Stand
Duojack
Duoplug
Duo-Lateral Coils
Headsets, Everytone
Jacks
Jack Set
Radioloop
Loop Plug
Loop Jack
Multijack
Pingo
Potentiometers
Rheostats
Resistors, Laboratory
Sockets
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RADIO ESSENTIALS

"DON'T IMPROVISE — PACENTIZE"

tune in and dial away in your corner. They are all provided with head sets. For instance, little Mary and John both like to hear the bedtime stories. They have a twin headset attached to one cord with one plug and they plug into their special hole. Your wife with her head set plugs into another hole and listens to her favorite concert. And two more holes and plugs and head sets are ready for guests. At last how to spend a quiet evening at home is discovered!

Classified Ads

(*Continued from page* 27)

of us in on the company. I didn't let anybody in that I absolutely didn't have to, naturally—and I was looking over the list this afternon, where we stopped for lunch and I find there's just thirteen. Rockefeller, Morgan, Armour, the Goulds—well, never mind who they are; but I swear that number's why I landed in that mudhole today."

"Take another in, and make it fourteen," says I.

He laughed.

"Ah—very likely," he says, wagging his head. "No thanks. We don't want to split a plum like this any more ways than we have to. The only way I'd do it would be to take on a dummy—just a nominal shareholder—twenty thousand dollars, or so; and, of course, nobody I know'd bother with chicken feed like that."

"I would," says I, not having poured my liquor into any palm trees.

He didn't seem to hear me.

"I would!"

"Eh?" demands Mr. Davidson, coming out of a brown study. "You would what?"

In order to save as many of these ten-cents-per-agate lines as possible, I will sum up what subsequently happened by stating that when Mr. Davidson left my place the next morning, he also left a beautiful certificate for five shares in the Sunset Oil Corporation, and carried with him my check for twenty thousand dollars, which he cashed at the Acacia National Bank as he passed through that city on his way to Red Dog and the border.

Bait! Bait! BAIT! For suckers, a specialty—Jim's Sporting Goods Emporium, Hazel Street.—Advt.

I am sorry not to be regaling my readers with jokes and descriptions of the local scenery, like F. R. Buckley and all them Western authors do, but you have got to remember that whereas they get paid more, the more they write, I am paying out the price of a good healthy heifer to get even a plain bald statement before the public.

Excuse me, accordingly if I kind of skip over my going to bed after Mr. Davidson's departure; waking up with a bad headache at four o'clock in the afternoon; finding a perfect stranger in a red shirt waiting for me; and riding with the said perfect stranger—who claimed to be Angus McGregor's deputy—to the city of Red Dog.

Owing to one circumstance and another my recent sociability being the principal cause—we were easily half way there before I even summoned enough ambition to ask what Angus wanted with me; and then either the deputy didn't tell me much, or I didn't understand what he did tell me, probably the latter.

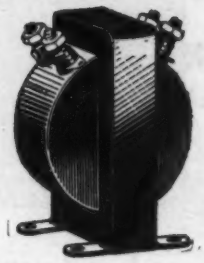
Anyhow, nobody could possibly have been more surprised than I was when we suddenly came across Mr. Davidson's yellow racing car standing idle by the side of the trail; and when, arriving at Angus McGregor's house, we found Mr. Davidson himself, not to mention his valet, sitting in two chairs with Angus between them and the door. Apparently, no violence had taken place theretofore; but my entrance seemed to apply what you might call a spark to the dynamite. Just as I pushed open the door, Mr. Davidson jumped to his feet with a kind of snarl, simultaneously reaching for his hip-pocket; and at that same instant, Angus McGregor did a Brodie over the table and hit the financier and his henchman simultaneously under the jaw. He fell. So did the valet, or secretary, or whoever he was—tipped over backward out of his chair and lay with his head in the ashes of the fireplace, howling like a motherless calf.

"Sold you some oil stock, didn't he?" asked Angus McGregor, recovering his balance and licking his knuckles. "Wasn't that your check for twenty thousand he was cashing at the Acacia National this morning?"

I suppose my dropped jaw gave consent. Anyhow, Angus picked up the leather grip that reposed under the chair recently vacated by Mr. Davidson, jerked a bunch of keys out of Mr. Davidson's pocket, unlocked it, and handed me a package of twenty thousand-dollar bills.

"This bird's wanted in four states, for usin' the mails to defraud," says Angus. "Alarm for him went out last night. He was makin' his getaway when he ran into you. Illegal for me to be givin' you your money back like this. Say nothin' about it. You're responsible for the capture in a way. I was over at the bank this mornin', gettin' one of my own checks cashed, an' heard him mention your name. Looked at him. Recognized him from the description. Remembered twenty thousand was just the amount you were goin' to leave Mary in your will."

Ready!



The Jones Transformer

Volume without distortion is assured by the use of the JOS. W. JONES Transformer. A low ratio audio frequency transformer which always gives maximum value of signal intensity. May be used in both stages and with all tubes.

Throw away your soldering iron and build with JOS. W. JONES parts: Audio Frequency Transformers; Variable Vernier Condensers; Low Loss Variable Grid Leaks, Vario-couplers, Potentiometers, Rheostats, Inductance Switches, Phone Plugs, Sockets; and Anti-capacity Jacks and Switches. Simple binding posts make all connections. And less drilling is required.

JOS. W. JONES RADIO TRADE MARK

"Improved" radio parts

JOS. W. JONES RADIO MFG. CO., Inc.

Home Office: 40-42-44-46 West 25th Street New York

Branch Offices:

Philadelphia: 1011 Chestnut St. | Chicago: Monadnock Bldg. | Boston: 99 Bedford St.

FREE RADIO CATALOG Sent You Every Month

ALL the latest improved apparatus is listed in our monthly bulletin: "The American Radio Transmitter." If it's new we have it.

Lowest Prices in U. S.

Our prices to dealers are the lowest in the United States. All nationally advertised goods at discounts that make you real money. Dealers, get your name on our mailing list. Simply send name today for latest, big monthly bulletin, showing 75 nationally advertised factory lines and 4,000 items.

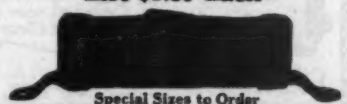
AMERICAN RADIO MFG. CO. 6 W. 14th St. Dept. U., Kansas City, Mo.

CRESCENT LAVITE RESISTANCES

ABSOLUTELY NON-INDUCTIVE

12,000, 48,000, 50,000, 100,000 Ohms

List $1.50 Each



Special Sizes to Order

USED IN ALL CIRCUITS AND RESISTANCE COUPLED AMPLIFIERS

When better resistances are made they will bear the Crescent label.

Dealers write for discount

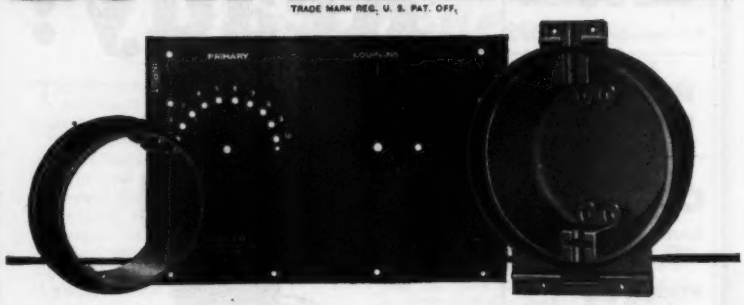
CRESCENT RADIO SUPPLY CO.

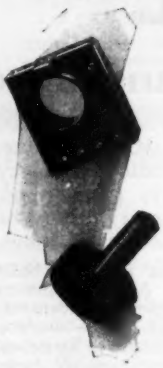
3 LIBERTY ST. JAMAICA, N. Y.

"Quality Goods for Quality Readers"

BAKELITE

TRADE MARK REG. U. S. PAT. OFF.





Endorsed by Remler, Too—

Manufacturers know from experience that radio parts must be constructed with the best materials, if satisfactory service is to be obtained. That is why the Remler Radio Mfg. Co. of San Francisco uses Bakelite for tube sockets, variometers and many other parts.

As an insulation, Bakelite is in a class by itself. It possesses high dielectric strength, is unaffected by atmospheric changes, and its properties are not impaired with age.

Insist on genuine Bakelite radio parts, and you can rest assured that your equipment is of the highest quality.

Send for our Booklet A

BAKELITE CORPORATION
247 Park Avenue, New York, N. Y.
Chicago Office: 636 West 22d Street

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Condensite
REDMANOL
are the registered Trade Marks for the Phenol Resin Products manufactured under patents owned by
BAKELITE CORPORATION

THE MATERIAL OF A THOUSAND USES

FARAWAY RADIO

$29.50
Gets stations Far and near Loud and Clear

FARAWAY Radio Sets are amazing values at bargain prices. Users get stations from New York to France—loud and clear. Operate with either dry cells or storage batteries. Beautiful cabinet finished in mahogany with new platinum-finished panel. SATISFACTION GUARANTEED Don't pay $100 to $150. Write for our *money-saving plan* and literature.

2-Tube Set - $29.50
4-Tube Set - 59.50

Dealers - Agents: Biggest possibilities you ever heard of. Write for plan and territory quickly.

THE FARAWAY RADIO CO., 650 W. THIRD ST., CINCINNATI, O.

OVERSTOCK BARGAINS
IN
Neutrodynes and Regeneratives
BELOW COST
Write for List W
J. H. BUNNELL & CO.
32 Park Place **New York**

"I—was tryin' to quadruple it for her," says I. "Why—why didn't you arrest the guy then and there?"

"I'm under bond. No false arrests. Wanted you to identify him."

"But if his car hadn't broken down, he'd be in Mexico by this time!"

"I put sugar in his gasoline while he was in the bank. Kills the engine after five miles or so. Then happened to come by with a led horse."

Well, I didn't say anything; some gratitude is too deep for words. But first I took a violent grip of my grandson-in-law's hands; and then I telephoned Mary a full and complete account of the affair. She seemed kind of tremulous when I'd finished; and remarked, with a desperate endeavor to be casual, that she would be down on the next train. When I told this to Mr. McGregor, he in his turn took a violent grip of my hands.

For the next ten minutes after that, we both were busy taking violent grips of the hands and the throats of Mr. Davidson and his valet, who seemed to be laboring under the delusion that, having been duly and legally knocked out, all they had to do was get up and shoot us with pocket-revolvers. The deputy had to come and help us to convince them that such wasn't the case.

I suppose this fracas, and the subsequent excitement of getting the two prisoners to the town lockup, was the reason why I didn't ask Angus any questions. However, Mary, who claims to be so smart, had been in the house a full ten minutes before she said anything either except "My Darling!" and such beside-the-point remarks. Gosh, what a reconciliation that was! Wonderful what young folks' ribs will stand.

"You'd never have thought of putting sugar in his gasoline if your mind had been full of that horrid radio business," says Mary triumphantly. "By the way—how did you get the alarm and the description of the man, if it was only sent out from Chicago last night?"

There was a terrible silence.

There was some more terrible silence, during which second instalment, Mr. McGregor started to go red from the neck up.

As he abandoned this pastime and began to go green instead, Mary gave him one blazing look, threw open the door of the inner room, and disclosed —a much bigger radio set than the one he'd smashed, all set up and shining on a table! There was a mirror on the inside of the bedroom door, too; and as she turned around to take a look at the shrinking Angus, she perceived that right bang across the back of her new vermilion silk waist, which she'd put on in honor of the heroic husband, there was a great big greenish stain in the shape of a human hand.

Davidson, when he fell for the fourth or fifth time, had knocked over a bunch of little boxes which I since learned were storage batteries. When Mary arrived, Angus had been busy wiping up a lot of water that'd run out of them. I have since learned that this water was sulphuric acid.

"You—" hissed Mary.

But at that moment, as I have since learned, she felt the sulphuric acid of that handprint quit work on her blouse, and start in on her back.

She therefore ceased to talk, and started to walk. She walked out of that house, and she walked down to the railroad station, and she took Number 17 home.

Having followed her thither, and being mindful of the return of my twenty thousand dollars, I took the risk of interrupting a two-hour crying-spell to plead with her on Mr. McGregor's behalf, pointing out as a grand peroration, the dangers of his trade or profession.

"I don't care!" storms Mary in reply to this. "I don't care if he's stabbed, strangled, stunned, or run over by wild horses. I don't care if he's drowned in molten lead. I don't care if he's shot till he looks like one of his own honeycomb coils. I don't care—"

She went on for some time like that; but the upshot of it was that she wouldn't return.

And I hope this $27.50 I've spent will keep you Red Dogs from any further wondering why not.

EDITOR'S NOTE: While out buying groceries with the proceeds of the above classified advertisement, ye Editor figured to drop in on our genial townsman and sheriff, Angus McGregor; who, as is well known, scalded both of his hands while endeavoring to make coffee for himself in a percolator yesterday.

Ye Editor was pleased and surprised to find that the news of this accident had reached Prairie Dog, and that Mrs. Angus McGregor had arrived to nurse her injured husband, wearing a handsome vermilion silk blouse with a large sailor collar of black silk hanging down the back. According to our genial medico, Dr. Brewer—whose advertisement of a car for sale appears in these columns—anxiety had made Mrs. McGregor slightly hysterical, but on being reassured that Mr. McGregor would live, she recovered, and spent last evening manipulating the dials of our competent, but bandaged sheriff's radio set.

"It really is remarkable," said Mrs. McGregor to ye Editor. "We got Pittsburgh as clear as a bell, and after Angus had gone to bed, about four o'clock this morning, I'm just certain I heard New Zealand. I'm going to try it again tonight."

When Winter Winds Blow Cold

FRESHMAN MASTERPIECE

The Greatest Value Ever Offered · In A Radio Receiving Set!

A 5-tube tuned Radio Frequency Set

made of the finest low loss materials and in a beautiful genuine solid mahogany cabinet, that is attractive enough for the most pretentious room, and at sixty dollars, economical enough for the most modest.

Combines all points essential to the perfect receiver. Real distance reception without that squealing and howling. So selective that once a station is picked up—it can be brought in again at the same points on the dials whenever you want it. And, what's more,

It is Mighty Easy to Operate

$60

Tuned Radio Frequency Kit

$17.50

It's Easy to Build

a five-tube radio frequency receiver when you use the Freshman Masterpiece Kit. The result will be a receiver that will bring in even the most distant stations with the volume and clarity of locals. The equal of any 5 tube set in selectivity, simplicity of operation and all around efficiency.

No Neutralizing or Balancing Condensers Required

Have Your Dealer Install One in Your Home!

All genuine Freshman Masterpiece Sets have a serial number and trade-mark riveted on the subpanel. The Receiver is not guaranteed if number has been removed or tampered with.

Chas. Freshman Co. Inc.
Radio Receivers and Parts
FRESHMAN BUILDING
240-248 WEST 40TH ST.-NEW YORK, N.Y.

THIS COMPLETE UNIT enables those who want to use the loud speaker in other parts of the house to do so without removing set. Insert plug from loud speaker into jack; place plug on end of cord, into set. This can be done readily and saves the trouble of using tools or soldering iron.

Something NEW!—
Loud Speaker Extension Unit
COMPLETE

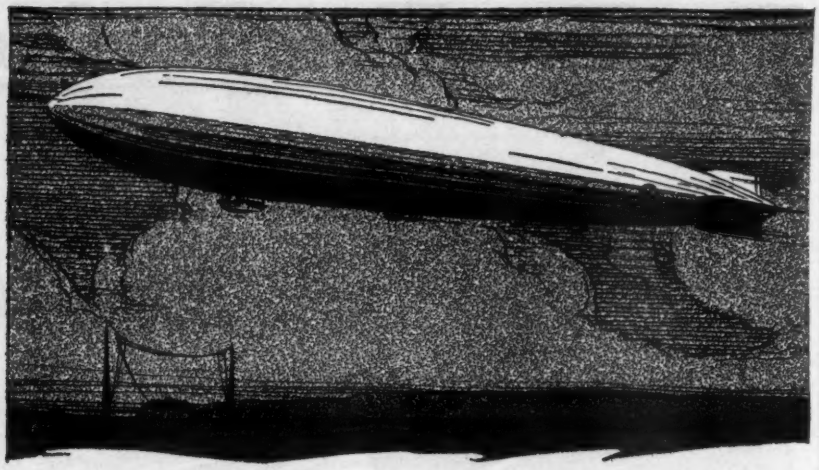
Prices, including Jack, Plug and Cord:

10 ft. cord	$2.25	40 ft. cord	$3.00
20 ft. cord	2.50	50 ft. cord	3.50
30 ft. cord	2.75	100 ft. cord	5.75

Manufactured by
Four Way Co., Springfield, Mass.

—at good dealers' everywhere

"Quality Goods for Quality Readers"



DUBILIER CONDENSERS

Important Links between the Shenandoah and Land:

Communication with land—under all conditions—at all times—this was the imperative need of the Shenandoah on its experimental flight across the continent. Impressed with this need, army and navy engineers equipped both transmitting and receiving sets with Dubilier mica condensers—not specially designed condensers but the regular standard product. Only complete confidence in the supreme reliability and efficiency of Dubilier condensers can explain their use in this important and daring adventure.

Dubilier

CONDENSER AND RADIO CORPORATION

Makers of Dots and Dashes

By PIERRE BOUCHERON

I RECENTLY learned that General Harbord, although a soldier most of his life, actually started his career as a telegraph operator back in 1884. It was at the railroad station of St. George, Kansas, on the Kansas division of the Union Pacific. He was substitute night operator; the call of the station was "RG," and the salary $40 a month. Later, the future General taught telegraphy at Kansas State Agricultural College. He was also a lineman on occasion.

It may or may not be significant that a great many distinguished Americans began as telegraph operators. A few in this galaxy of stars are Andrew Carnegie, Thos. A. Edison, Frank A. Munsey, Edwin M. Herr, David Sarnoff, Colonel Robert Ewing, James M. Crea, R. C. Clowry, William Gillette. One meets "ex-brass pounders" in every walk of life; there are thousands of them.

This great brotherhood of Morsemen holds closer ties perhaps than any other profession. Whether still operator or not, one has an immediate feeling of warmth toward the stranger who knows the meaning of "73," of "om," of "os." I have seen at least two of the above stars stand close to the sounder of a chance telegraph office and, almost surreptitiously, read the stuff going on over the wire—this, years after they had ticked off their last official "ok" to a message.

I saw a strange light come to the eyes of these big men. And when I dropped my gaze down to their right hands, I thought I detected the unconscious movement of the first three fingers to the "Catlin grip" position. I have even seen one, great man though he was, almost beg the humble telegrapher in charge to let him send a regular message again—"just to see if I can still use the fist."

John Stone-Stone

(*Continued from page 31*)

working for telephony and telegraphy, and after that in radio broadcasting.

Dr. Stone was born Sept. 24, 1869, of American parents within the shadow of the Khedive's palace in Egypt—his father holding an official position in connection with the educational projects of the Egyptian ruler. In after years it was rather startling to hear from the office of this profound investigator a sudden series of exclamations in guttural language, percolate through the door whenever results were not coming as they should! Dr. Stone's earlier education led him finally to Johns Hopkins University, Baltimore, where he met and knew intimately Major-General George O. Squier who since has developed line radio for "narrow casting" purposes.

The 100% Self Shielded Transformer

has made a big hit with both set makers and set manufacturers because of its small size, its amazing volume, and most of all, because of its **pure, undistorted tone.** It is half the size of other transformers, but its results are unsurpassed. Absolutely new and scientific design and construction. Ratios 1 to 3, 1 to 4, 1 to 5, $3.50; Ratio 1 to 10, $4.50.

SEND FOR BULLETIN No. 94. Read all the exclusive features of this and other Premier parts. Tells how to get free hook-up diagrams beautifully printed in two colors.

Premier Electric Co., 3806 Ravenswood Ave., Chicago

PREMIER *Quality* Radio Parts

THE FAMOUS

BEL-CANTO LOUD SPEAKERS

***NOW* at your DEALER**

10" Bell, 22" High.....**$10.00**

15" Bell, 29" High.....**$15.00**

(Goose neck)

If your dealer cannot supply you write us and we will advise where to purchase one.

BEL-CANTO RADIO AND TEL. EQUIP. CO., Inc.
872 B'way, N. Y. C. Tel.: Stuy. 1921

"Quality Goods for Quality Readers"

Both these investigators were pupils of the famous professor, Henry A. Rowland, who experimentally proved that a moving electric charge is equivalent to an electric current in all respects, thus crowning the edifice which Maxwell had built years before and which is at the basis of all radio engineering.

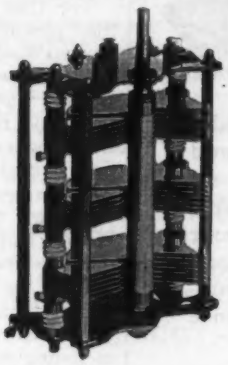
Dr. Stone, about 1890 was employed as research engineer by the A. T. and T. Company where his marvelous grasp of the mathematical processes of the differential calculus led him to master the almost impossible methods used by Oliver Heaviside in England. The chief difficulty of Heaviside's methods was that he took an impish delight in solving some profoundly obscure problem in electric transmission of impulses by means of a new method which he called "the operational method." He meant by this that instead of treating symbols to represent quantities that he treated them to represent mathematical operations. He discovered the laws of these operations, but gave no general justification for his system in the form of a detailed and exhaustive proof. It was very exasperating to those who tried to follow him.

Stone, however, in spite of these difficulties filled out the missing proof for his own brilliant researches and got into communication with Heaviside. This rather "porcupinish" English genius came out of his retreat and actually sent a letter of almost tearful appreciation to Stone hailing him as the first one to really appreciate his work.

In blazing this trail for all subsequent mathematical physicists, Stone found that the method was so concise that the chief difficulty after the problem was solved in the form of "operational equations" was to interpret the results and narrow them down to a particular case. All those who followed the method had a great advantage over their contemporaries using the older methods, and it is only recently that engineers like Fry in the Western Electric Company, Carson in the A. T. & T. Company, Nicholson and a few others have used the methods employed by Stone and his assistants twenty years ago.

The result of Stone's work was that he became very much interested in the question of simultaneous telegraphy and telephony by means of what we now call "carrier waves." One of the earliest patents on this problem caused an interference between the French engineers Hutin and LeBlanc, Michael Pupin and Stone. After an incomplete prosecution short of the highest court the case was dropped for financial reasons. It is interesting to note that at this early date—about 1893—there was a difference of opinion

GENERAL INSTRUMENT
MULTIPLE
VARIABLE CONDENSERS
LICENSED UNDER HOGAN PATENT 1014002 FOR
SINGLE CONTROL WORK



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(TRADE MARK)
INSULATED WITH PYREX
INSULATED WITH ISOLANTITE
TYPE 75 DUO CONDENSER $10
TYPE 76 TRIO CONDENSER $15

GENERAL INSTRUMENT CORPORATION
MANUFACTURERS OF LABORATORY EQUIPMENT
423 BROOME STREET
NEW YORK CITY

fits any Grid Leak mounting

FRESHMAN PLUNGER TYPE VARIABLE GRID LEAK
was designed especially for the non-technical set owner who can replace in an instant the fixed grid leak with this new, efficient cartridge type Variable Grid Leak: without requiring the change of a single wire.

At your dealer or by mail postpaid. Write for free catalogue.

65c

240-248 W. 40th St., New York

AMBASSADOR
Low Loss Products

Master Tuning Coils
Twin Tone Head Phones
Low Loss Condensers

High grade, standard radio products that will increase the efficiency of any set and add to the satisfaction of the user. Ambassador Low Loss Products have long been the choice of particular fans. See them—compare them, and you will choose them too.

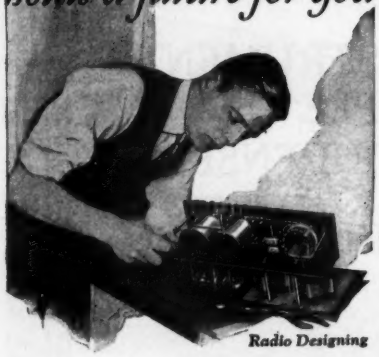
At all good dealers.

Write for free diagrams of circuits in which Ambassador products can be used.

AMBASSADOR SALES CO., INC.
108 Greenwich St., New York
326 W. Madison St., Chicago

"Quality Goods for Quality Readers"

RADIO
holds a future for you



Radio Designing

The limitless field of radio — growing by leaps and bounds — daily opens up new opportunities for success. And here is your opportunity to qualify for a good position — with substantial pay and a chance to grow with radio.

STUDY RADIO AT HOME

You do not have to give up your present employment. The Radio Institute of America—the world's oldest radio school—with 7,000 graduates—now offers a *new and completely revised* HOME STUDY COURSE in radio that will prepare you to successfully pass the U. S. Government examination for a Commercial Radio License.

RADIOLA III — FREE with course

An omnigraph, a buzzer set, up-to-date text-books, and *Radiola III with two tubes and Brandes Headset* are free with the course. These are the best text-books and apparatus obtainable.

The Radio Corporation of America conducts the school. The largest radio companies give employment preference to our graduates because of their superior training. Mail the coupon today for more information.

Radio Institute of America
(formerly Marconi Institute)
Established in 1909
326 Broadway New York City

Radio Institute of America
326 Broadway, New York City
Please send me full information about your Home Study Course of radio instruction.
☐ I am interested in the complete course including code instruction.
☐ I am interested in the technical course without code instruction.
Name .....
Address .....
.....

among experts as to what was meant precisely by "resonance." On the one side was Dr. Kennelly of Harvard and on the other side was Stone. The latter maintained that from a physical standpoint, the frequency of resonance was that at which the maximum current occurred in a tuned circuit. The former maintained that the resonant frequency was that at which the condenser reactance equaled the inductor reactance. These questions are not of serious engineering importance today, but a great deal hinged on them in this classical suit.

We thus see that Stone is one of the precursors of "wired-wireless" now so successfully used for telephony between two important cities in the United States where five simultaneous telephone messages are sent through wire and cable circuits by the use of five separate carrier waves of inaudible frequencies.

Again, we find that Stone as a pioneer had the talent to solve the most difficult mathematical problem then before the world of radio investigators; that is, the problem of the performance of two coupled circuits including resistance of radiation from the antenna, and even the skin-effect in the circuit. This work unfortunately was never published, but was checked up afterwards to the work of Max Wien who had also become interested in the question of coupled circuits. The result of this work was that Stone in 1906 was tuning out frequencies using spark transmission when the difference between these frequencies was as small at 3 per cent.!

Another early investigation of Stone's which showed his vision, is that which he undertook in collaboration with Dr. Ladd of Boston about 1900 in direction finding by means of experiments made with extremely short waves of about the same length as those used by Hertz in his famous experiments. The power used by Stone was far too small to give the results which have recently been obtained by Franklin and Marconi using C.W., but the methods used were the same and the results over short distances were practically what we have today over longer distances

These experiments using damped waves led Stone to develop his transmission system whereby the energy from the "Whip-crack" circuit was stored in a second circuit having very small damping. This circuit together with the famous "intermediate" or "weeding-out" circuit gave Stone just as small a damping in his transmitter (down to .02) as he desired and for receivers he reduced his damping to a fraction of the above amount at even these early dates in laboratory experiments.

The patents granted him could have been used to apply to the entire art

JEWELL

THE JEWELL
RADIO TEST SET

¶ This portable radio test set is the only complete set of its kind on the market and was designed to meet the demands coming to us from serious experimenters, manufacturers and radio dealers for a complete testing outfit.

¶ While the various ranges of readings permit making practically every test necessary in connection with radio receiving sets, it is especially valuable for the taking of characteristic curves on vacuum tubes.

¶ The several instruments may be used independently, and include an 0-1.2 filament ammeter, an 0-6 filament voltmeter, an 0-120 plate voltmeter, an 0-10 plate milliammeter and a 10-0-10 grid voltmeter.

¶ Ask your dealer or send for Special 14-C circular. Also 15-A complete radio catalog.

Jewell Electrical Instrument Co.
1650 Walnut Street — Chicago
U. S. A.

No. 57 "A" and "B" Battery Double Range Voltmeter (7½ and 150 Volts) $10.00

of transmission and reception if he had so chosen, but he was too engrossed in the science to bother with the commercial aspect of radio. His accomplishments were made possible to some extent from the fact that he was the only worker at the head of an organized company who seemed to have a clear idea of all the factors which determined "selectivity" in the circuit. What is even more important in regard to early receiver design is the fact that he was able to show the connection between selectivity and great persistency in the wave-train of a circuit in regard to the sharpness of tuning obtainable with it. A great many modern so-called wave traps are nothing but Stone's weeding-out circuit under different forms.

Stone did some of the earliest work in the country on stationary waves on wires and, together with the writer of this article, got out the first direction finder by means of radio waves without "swinging" the ship. This was done by stationary waves on a kind of dephasing device by which electrical angles were measured instead of turning the ship.

In 1904 Stone at St. Louis delivered some papers before the International Electric Congress and the Canadian Society of Civil Engineers in 1905 at Montreal. He also read papers before the Society of Wireless Telegraph Engineers and Institute of Radio Engineers. He was awarded the Edward Longstreth Medal by the Franklin Institute in 1913 and the Medal of Honor of the Institute of Radio Engineers in 1923.

Among the useful inventions which were used by operators and developed under Stone, there are found a practical "break" system, so that operators may interrupt each other even when using as high as fifteen K.W. input. Closely related to this was a patent by which the usual lowering of voltage in a transmitting room from 110 to about 40 with the key down was done away with. By obtaining what is known as "unity power-factor," Stone found that his apparatus acted as a pure resistance load and did not either magnetize nor demagnetize the field of his A.C. generator. The net result was that in 1907 at the Brooklyn Navy Yard with George Davis as chief operator at the station called "PT" it was possible to throw on a full load of 15 K.W. and see the voltage change only from 112 to 110½.

Another interesting apparatus which was successfully tried out before (then) Commander S. S. Robison of the U. S. Navy, was a secrecy-sender by which a message could be delivered without much possibility of an enemy "listening in." This device had a transmitter which sent out a continuous

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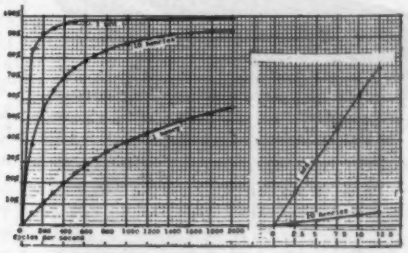

INDUCTANCE. Inductance in series with the plate supply suppresses a certain per cent of the a.c. component, dependent upon the frequency of the ripple and the value of the inductance. The curves show the per cent of suppression for a 1 henry and a 10 henry choke at common ripple frequencies for a small transmitting tube. For comparison the percentage of ripple by-passed by a 1 mfd. condenser as outlined in "No. 2," is plotted to the same scale. The insert curves are the 1 mfd. and 10 henry curves replotted to show their effects at the very low frequencies common to moving contact disturbances. Note the change in the shape of the curves as the inductance is increased, that the increase in suppression is not directly proportional to the value of "L" and that a small choke will be of little use especially at the lower frequencies.

The condenser curve should not be mistaken for a percentage reduction in ripple. It does not represent suppression, but by-pass. Reduction of the ripple thru the plate circuit takes place only when the current thru the condenser has become so large that it "breaks down" the ripple voltage. This action is dependent upon the design of the generator, and the load that it is operating under.

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This illustrates the "magnified reproduction" principle of Rhamstine* Needlephone. The delicate vibrations of the reed at "C" are transmitted through the pivoted needle and magnified at "A."

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Radion resists warping. It's strong. It's moisture proof. It comes in eighteen stock sizes and two kinds, Black and Mahoganite. Radio dealers have the exact size you want for your set.

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Our new booklet, "Building Your Own Set," giving wiring diagrams, front and rear views, showing a new set with slanting panel, sets with the new Radion built-in horn, lists of parts and directions for building the most popular circuits—mailed for ten cents. Mail coupon today.

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"nonsense message" on about 600 meters and alternate signals as dots and dashes at 570 and 630 meters respectively. The receiver was tuned to both these latter frequencies and excluded the "nonsense frequency." But alas, it had fourteen adjustments. These all had to be set by calculation so as to be simultaneously correct. Cut-and-try methods simply worked in a circle and produced chaos!

In quoting the above instances of very early work demanding a knowledge of how to obtain high selectivity and pure waves twenty years ago, it is merely desired to emphasize the fact that the natural genius and sincerity of this investigator led him to avoid the temptations of a very active stock market, based upon radio, which was then at high tide.

Perhaps the one outstanding short and sharp achievement which Stone has left to the radio art is the fact that he pointed out that close coupling is the inveterate enemy of sharp tuning and pure radiation and he not only showed why this was so, but he showed exhaustively how all the various factors which entered into this condition are related. He not only answered the question "in what way?" but he also answered the question "to what degree?" No engineer can do more.

It is impossible in a brief article to describe the more than one hundred patents granted to Dr. Stone. Many of them were transferred to the A. T. and T. Company some years ago, and today have run out. Stone was the first to point out to those interested what an ideal telephone repeater the vacuum tube would be; as he had been working on the original problem of the repeater with Dr. White back in the early 90's.

To the men who worked with Stone, namely Sewall Cabot, Fred Holster, Ernest R. Cram, George H. Clark, and the writer, his personality as a cosmopolite, his polish as a man of the world, his personal magnetism and his remarkable powers of analysis have been sources of inspiration in all their subsequent professional work.

Dr. Stone was one of the first to examine the question of an auxiliary language for engineers and other professional men in 1905 when the great physical chemist, Ostwald came to the United States as the champion of Esperanto. Unfortunately both Ostwald and Stone decided that it was too unscientific and uncouth in appearance and pronunciation to be of service. They both have gone over to the younger and more carefully developed system called Ilo (Ido) and Dr. Stone is now, together with Mr. E. F. W. Alexanderson, an honorary president of the Radio Auxiliary International Language Society with headquarters

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(Below)—*Dog Sleds Carry Them to the Arctic Outposts of Civilization*

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at Beacon Chambers, Boston, Massachusetts which is spreading a knowledge of radio in foreign countries by correspondence.

Radio-Paris

(*Continued from page* 19)

the application fee costs 16 francs. He must be able to send and receive 8 words per minute. For an experimenter's license, the speed requirement is 15 words per minute. He must be able to adjust his apparatus for use on three different wave lengths.

"There are also restrictions of a political nature, such as the permission of French only as a language of transmission. Special methods of transmission are forbidden. Some of the radio papers have objected to this as a discouraging factor in experiments. All transmitting stations in France are required to pay 100 francs per year per kilowatt. This is the total sum which the amateur or the experimenter has to pay in taxes. There is complaint that only 60 conversations can be maintained between 150 and 200 meters and that private radio communications are already cramped in this narrow band. There is also considerable complaint of interference from outside the boundary of France. One of Holland's big stations is causing considerable interference in France. You must remember that France is about the size of an American state and that obviously stations from other nearby territory break in upon her. However, this is a sword that cuts two ways—the Eiffel Tower and other stations no doubt interfere with other countries. It seems to the American like the same old petty politics of nationalism to sit on the lid of radio for political and nationalistic reasons. Yet this is what is occurring in Europe.

"England herself only recently cleared her skirts of this political hamper to radio and has developed enormously in radio broadcasting since that time. Because of considerable interference only the Parisian listeners-in hear at all well; and the listeners-in over the rest of France haven't very much success. This is extremely prejudicial to the best interests of radio, and it is probably just as well that the country districts are not yet thinking of radio very much, since the service is pretty poor.

"Next year an international conference is going to meet to agree upon wave lengths, and undoubtedly much of the same broad-minded clearing up of interference will take place in Europe that has taken place in the United States.

"One of the evidences of radio's lesser stature in France is how the Parisian newspapers treat it. Every American is familiar with the special weekly radio magazines issued by many newspapers or the many columns of material given in regular pages. Parisian papers—even the Paris New York *Herald*—which is printed in English—have only a couple of inches, single

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column, with an ambiguous heading giving space to radio, 'For Radio Amateurs.' As a rule only three stations are mentioned—'Radio-Paris,' which has a wave length of 1780 meters; Eiffel Tower with a wave length of 2600, and Ecoles des Postes with a wave length of 450 meters. These programs are set in the smallest type used in the newspaper, located in an inconspicuous corner, and certainly do little to stimulate radio interest."

"What are the programs they broadcast?"

"Well, for instance, at 12:45 Radio-Paris has some orchestra music; at 1:45 a news bulletin; at 4:45 some concert of the music of Wagner, Saint-Saëns, Massenet; at 5:45 news bulletins; at 8:30 some more news bulletins; and at 9:30 P. M. dance music. The *Ecoles des Postes* broadcast the Jaures' memorial ceremony outdoors at the Pantheon and various other places. At 2 P. M. a speech by M. Herriot. All three stations give news bulletins more frequently than anything else, which again illustrates the Parisian and French character—the constant overshadowing interest in politics.

"In America news material is definitely stale and undesired as radio material, except for selected special events. We Americans prefer our newspapers for the news, and look to radio for entertainment, music and instruction. The Frenchman, on the other hand, is so primarily political-minded that when the program says 'News Bulletin' it means, to a large extent, political news, for the Frenchman has not a great deal of interest in the news of other countries, excepting where it rather definitely impinges upon French interests or concerns French international diplomatic controversies.

"Another thing that seems entirely absent in French broadcasting is the famous American bedtime story. French children apparently still have this thrill coming to them.

"It certainly will not do, however, to cast any slight upon French genius and character in respect to radio, for already something is developing which may give to the world some of France's best genius in relation to radio. A number of men, one of them a chief of a modern broadcasting station, is working up technique and interest in 'A Wireless Theater.' This is Gabriel Germinet, who is collaborating with Pierre Cusy, a writer who has several novels to his credit, written while wounded, and who is Chevalier of the Legion of Honor. Germinet hopes to develop a theatrical technique which will enable the listener-in to thoroughly enjoy a theatrical performance via radio. The French genius for the theater is thus tackling a problem that is within its sphere, and we may hear

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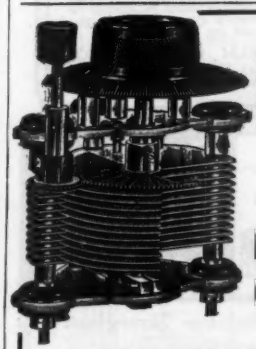

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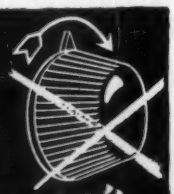

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something about this later on.

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"Special mechanical devices and ingenious methods were used for the onomatopoeic sounds (the imitations of noises), peculiar to the play's location and action. In fact, in this new theatrical art of radio plays, there is, of course, no scenery — all is *sound*. Therefore, the various means of making sound are important, and a radio playwright has naturally to learn and devise many new things. A sea play, with the action laid on shipboard, offers many unique sound possibilities. A saxaphone was used for the roaring of the sea in a storm; and a piece of silk stretched taut, and played upon violin fashion made a perfect imitation of the wind swishing through the rigging. No wonder that not only the radio listeners, but even some of the newspapers were taken in for a while —they really believed that the broadcasting was done on shipboard. The Parisian newspapers wrote ecstatic blurbs about the play, and a great many letters were received from fans enthusiastic over the new art.

"You see, the French are great theater-goers, and love the spectacularly dramatic. If this new radio theater art can be put across, and playwrights developed who will be able to make artistic use of radio technique, we may see a new dramatic development as important as the movie. The movie, after all, appeals to but one of the senses, sight; which misses all the inflections and drama that lie in sound—in spoken words. Radio can have words and also sounds of other kinds.

"A book is being prepared on the subject, and not only the wireless field, but also the theatrical field is much interested. In *'Comoedia'* a well known French theatrical paper, Max Frantel said after the première of 'Maremoto': 'In a few years we shall be proud to say that we were at the first presentation of this first radio play. The radio papers likewise had lively reviews and comment.

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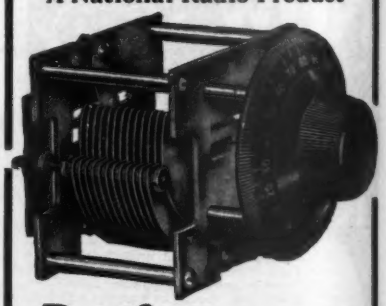
Tie up to him

"The play 'Maremoto' was written incidentally, in a competition by *'Impartial François'* a newspaper, for a 5,000-franc prize.

"I think one of the most significant situations in French radio is the royalty situation, in view of conditions in this country. Certainly French artists exhibited nothing like the broad liberality over a number of years, which the American artists have shown, and if anyone is inclined to judge harshly the demand of American artists for pay from radio stations, one has only to consider the French situation to realize that they are certainly not unfair in their demand for pay. The French law basically provides for royalty for artists, for the artist has in France always been a person whose interests were well guarded and taken care of. That is the special glory of France, for by means of it she has fostered art until she is the most artistic nation in the world. Public and private support for the artistic accomplishments of her race have always been abundant.

"Precisely the same royalty rates which exist in the theater are operated in broadcasting. It is arranged in this way: Radio-Paris buys the annual right to use the material and music of members of the Society of Authors and Composers. Complete programs are sent to the Society every month, and these form the basis for proportioning the payment of royalties. It is true that Eiffel Tower and P. T. T. stations do not, at present, pay their artists. Subscriptions are offered by listening fans for this purpose. Radio-Paris, however, being a commercial broadcasting station, needs a great part of its income for giving the Composers

A National Radio Product



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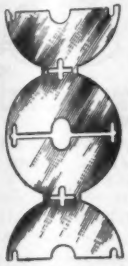

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and Artists what they are entitled to by law, since it is a private broadcasting company. Radio-Paris has now arranged to broadcast from *Salle Gaveau*, where piano recitals and stringed instruments are to be heard in concert, and these are now part of its program. Radio-Paris also hopes to acquire a large hall in order to operate a double plan of concerts to large audiences, while at the same time the performance is broadcasted. Radio-Paris has spent 2,000,000 francs on the new station at Clichy not far from Paris and is hoping to get permission for a 10-kilowatt equipment. If such permission is granted, we will certainly be able to hear this best of all Paris stations without difficulty in America. It will be on 1780 meters. Radio-Paris now has a studio located at 79 Boulevard Haussmann in a basement which is not at all satisfactory. Even the River Seine overflowed into the studio not long ago and artists had to walk about on planks. Such a condition is almost inconceivable in America."

"What about the French radio receiving sets—what are they like?" I inquired.

"Well, they are certainly not like our own. As in England the French do not even call a tube a tube, they call it a 'valve.' An outstanding characteristic of French sets is the mounting of the tubes outside the cabinets. Oddly enough this has been copied by some in American radio, whereas the tendency in France is now away from this and toward enclosed tubes. Sets with a loop antenna are sold in very handsome finishings, in black morocco, leather, walnut, and mahogany, and the loop antenna sets are decidedly popular. French ingenuity has evidenced itself in disguising the loops in screens, tapestries, etc., while French textile genius has produced a triumph—embroidery and silk, harmonizing with your furnishings, with a loop made up inside of it!

"Another one of the unique types of receivers is in a cabinet closing like a roll top desk. The Winter Radio Show at the *Grande Palais* indicated considerable use in France of pancake or other interchangeable inductances. Their general technical detail is otherwise not essentially different. It would appear that a constant stream of new circuits and hook-ups does not intrigue the French very much, for they seem to be doing very well with the ordinary single and three-circuit regenerative hook-ups. As for experimenting with super-regeneration and super-heterodynes, they were at the Exposition, but the buzzing crowds of fans displayed only ordinary interest in them. Radio-frequency amplification is used by some manufacturers."

"What do they do for loud speakers?" I asked.

on the dot

It's as easy as pl[ay]ing your pencil poin[t] on a town on the ma[p]—this tuning in with A[pex] Vernier Dials.

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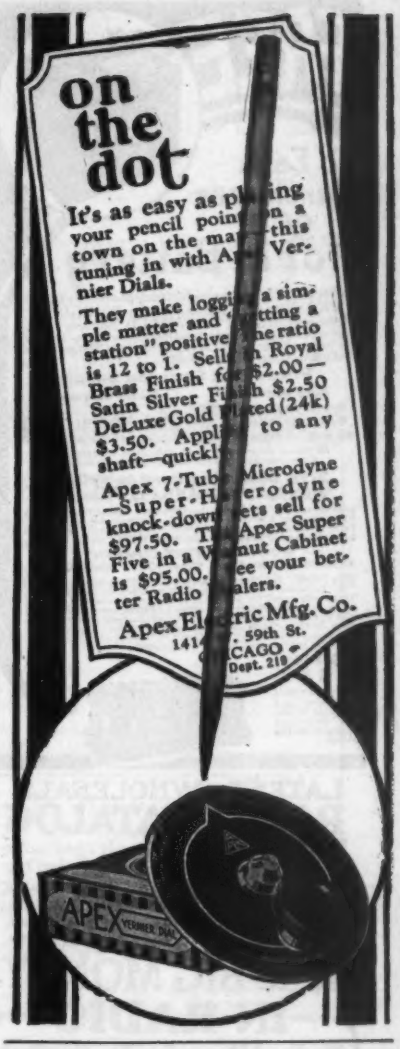

Laboratory Figures Convince Engineers

Results Convince Users

A prominent engineer reports that "laboratory tests consistently show that, if it were possible to make a tuner with lower losses than

THE LOPEZ LOW LOSS TUNER

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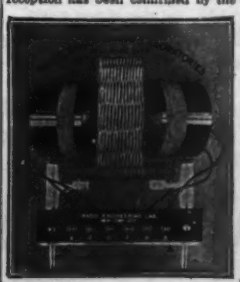

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"Funny, that seems to be the problem all over the world. The French are particularly in need of it. As I have said, transmission is not highly satisfactory and the French, no more than anyone else, do not like to be muzzled in ear-pieces for any length of time. There is, therefore, a large variety of loud speakers on sale in France, possibly a greater and more motley variety than even our own, for in America a fairly standard type seems to have been developed. There are crinkly paper cones, old fashioned gramophone horns and other bizarre shapes. An engineer named Lakhovsky has produced something new in this direction consisting of two horns fitted one within the other, the space between being occupied with an oil which is solid at normal temperature. Tap the edge of the horn and it will not ring. The diaphragm is made of two plates instead of one with a thin layer of the oil paste between them. M. Lakhovsky, the inventor, was one of the committee to award a gold medal to M. Leon Deloy at Nice, the first French amateur to communicate with American amateurs."

"Are there many radio stores in Paris?"

"Yes, there are quite a number of them, but hardly to the extent with which we are familiar in America. Nor are there many radio publications. Some that are worth looking at are: *Radioelectricite, T. S. F. Moderne, L'Onde Electrique,* (of more strictly technical appeal); the *Radio Review* (official monthly of the Radio Club de France), and *Radio Amateurs* (official monthly of the Association of Radio-Amateur Français)."

"How about DX nuts? Have the Frenchmen developed them yet?"

"Oh, yes, indeed. A French 'fan,' of whom there are, after all, a few, has all of Europe to prey upon. What with the English stations working between 353 and 495 meters, with the new Chelmsford station at 1500; Belgium between 1100 and 1300; Germany on 2700 and 400; and Holland on 1050, a DX fan needs only some good interchangeable coils and he has the makings of a League of Nations Convention in all languages. Of course, a French DX fan, unlike an American, has to be something of a polyglot in language qualifications, for he will hear one minute a señorita sing, and the next moment he can tune in a Dutch maiden or a German gretchen or an English lassie, all doing their national songs in their own languages, all by the turn of a wrist. To make this interesting he really ought to know what they are singing so cutely! Jazz is the new international musical language which apparently has a more ready popular acceptance than any other single type of music.

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What's the Trouble?

(*Continued from page 46*)

ment, as the prongs in this position hold their elasticity and there is no danger of a loose contact. This matter of socket contacts is a serious one and causes a great deal of trouble which may confine itself to merely a noisy set, but very loose contacts are sometimes responsible for the set, going dead entirely.

In building up your set it is always wise to solder all contacts and connections between the grid binding post on your detector socket to the grid condenser and to the coil to which it eventually reaches. In soldering you may drop rosin or solder itself in such a way that the grid condenser will be shorted. Be sure you don't do this. Good grid condensers have solder tabs especially placed for the greatest convenience. Remember that a good soldered connection does not consist of a great, big drop of solder, but rather a neat strong joint from which all surplus solder has been drained by placing the iron beneath the connection and allowing the surplus solder to flow off to the iron.

Book Reviews

New Robison's Manual

THE Sixth Edition of "Robison's Manual of Radio Telegraphy and Telephony" has just been brought out. This Manual has, since 1907, been the authorized text book of the Navy Department in radio matters, and although five editions have revised the work of Commander (now Admiral) S. S. Robison, the original author, the Manual still bears his name because of his always intense interest in radio matters and his great work in the betterment of Naval Radio in the early days.

Previous editions have been quite brief and more or less limited to types of apparatus of particular interest to the navy. Commander S. C. Hooper and his staff of technicians revised the present edition to make it of such character and scope as to be of value not only to the more or less skilled personnel of the navy, but to the public in all of its phases of interest and ability in radio matters.

The new book is an excellent example of how well the navy meets a demand made upon it. It covers 900 pages of radio subject-matter divided into logical sub-headings, and the various subjects are treated in clear and non-technical language for the layman, while mathematical interpretation is given for those interested. The treatment throughout is from a totally unbiased point of view.

Only a limited number of copies are available from the first print, but should the book find a large demand the Naval Institute stands ready to meet all requirements.

Afloat and Ashore With the Operator

(*Continued from page 53*)

diately. The judge ordered the bailiff to produce him—Me!

On the witness stand—for there I was landed double-quick—the grilling started. I refused to give information as to what messages had been received, whether I had sent one to New York requesting the defendant's standing or received one about him.

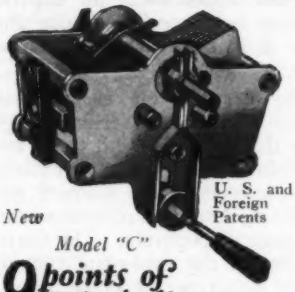
The defendant's lawyer—keen sighted and alert—finally made me admit that the exhibited message was not on the proper form.

Showing the message to the jury he branded it as a fake and then demanded that it be discarded. He was so insistent that it seemed to all that he had won his point when the opposing lawyer raised objections.

"Of course, Your Honor, it is a fake," he said—greatly relieving my feelings—"but it coincides with every other bit of evidence. It is all fake—the entire trial is a farce. The message has a rightful place here and I demand that it remain."

That clever changing of the tide won the case for his side, the jury voting his way unanimously.

The defendant? Well, the jury also asked clemency with the recommendation that he be sentenced not to enter upon the kingdom of Neptune again unless on his honeymoon trip and the solemn judge so ordered.



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FOR THE ONE-CONTROL 3 CIRCUIT TUNER

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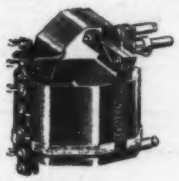

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A-225

One-Tube Transmitters

(*Continued from page 62*)

mind the idea of tuned-impedances presented in the description of circuits A to G.

Different (?) Circuit Arrangements

And now, after what we fear to have been a tiresome discussion, we come to the very interesting matter of one-tube transmitting circuits as they appear under various names in our radio magazines.

In the diagrams of figures 1 to 8 appear the best known transmitting circuits. They are stripped of all extraneous details, but retain their characteristic appearance; an experienced amateur can "spot" each one and tell what it is immediately; too immediately.

The first circuit is a Meissner, named after the German engineer. Note that in this circuit there are two tuned-impedances; one terminal of each connects to the filament and the remaining terminals connect to the grid and plate respectively. The draftsman has shown the grid-plate coupling as purely inductive; we know better. We know that the coupling is partly inductive and partly capacitive.

In figure 2 the circuit has been redrawn with the grid coil on top of the plate coil; the connections are exactly the same as before and indeed it is still recognized as a Meissner.

Now if the draftsman shortens the connection between the two impedances, but leaves the circuit just as before we have the circuit of figure 3 which is now called not Meissner but Hartley or "center-tap." The fact that the draftsman indicates that the coupling between the grid and plate circuits of figure 3 is apparently fixed does not mean anything at all. The coupling may be changed by varying the effective impedance in the grid circuit so as to increase or decrease the amplitude of the grid voltage variations.

Here we are not concerned with constructional details nor with the method of frequency control.

There is no difference between figure 2 and figure 3. So we can say that 1 equals 2 equals 3.

In figures 4 and 5 the draftsman has juggled the plate impedance into different positions with respect to the grid impedance. True, the circuits look different from each other and from either 1, 2 or 3. But follow out the circuit. There are two tuned-impedances; one terminal of each connects to the filament while the other terminals connect to the plate and grid respectively. So we can say that 1, 2, 3, 4 and 5 are equal to each other.

Now for figure 6. The draftsman indicates that the grid and plate impedances are not in inductive relationship to each other, so we generally think of the coupling as being that owing only to the capacity between the plate and grid. Actually as we know there remains a certain amount of inductive coupling, especially in a transmitter where the magnetic field surrounding the plate impedance may be comparatively enormous. So as the difference here seems to be only in the method of coupling and as that is but a "paper" difference, we can very safely say that 6 is just the same as 5 and 4 and 3 and 2 and 1.

For the purpose of further comparison note that figure 6 is just the same as figure 0, that is, 6 equals 0.

Now recall what has been said about conductive coupling in conjunction with capacitive—and of course residual inductive—coupling in reference to the circuits P and Q. We showed the equality of Q, P, O and M.

We will immediately recognize in figure 7 the circuit of figure P. The only apparent difference being that the lead from the grid impedance connects to the plate tap on the plate coil rather than to a separate tap as shown at P. The reader can conveniently imagine that the grid tap has been moved up till it merged with the plate tap, in other words that both taps have been adjusted to the same point on the plate impedance. The draftsman might just as easily have moved the grid tap up on Rx in figure P so there would not be even an apparent difference. As we have shown figure P equal to figure 0 and as figure O is equal to figure 6, then the circuits of 6 and 7 must be equal.

In figure 8 the draftsman has merely moved the grid impedance up a bit from the arrangement of 7, but he has not disturbed the circuit nor even the apparent method of coupling. So of course 8 equals 7.

From our equalities, or indeed from a glance at the diagrams if we thoroughly understand the first two sections of this article, we can see that the circuits of 1, 2, 3, 4, 5, 6, 7 and 8 are equal to each other.

This is the same as saying that the names of the circuits mean but little; very little. The accuracy of this statement may be checked by reviewing the entire article.

If we have omitted any special circuit the omission is certainly not intentional. The reader is at liberty to submit to the writer any circuit supposedly different from others; he will gladly endeavor to strip the circuit of its unnecessary adjuncts and show the similarity between it and the rest.

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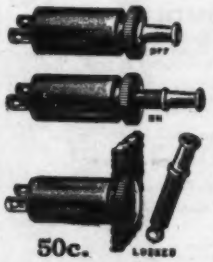

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8 JZ Paul D. Tennant.....Shinnston, W. Va.
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8 UP Merrell Kent.....517 Tenth St., Monessen, Pa.
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8 ASH Emory E. Bowen.....R. F. D. No. 5, Ionia, Mich.
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8 COC Clyde H. Peet.....Coral Ave., Trilby, Ohio
8 CBQ Charles K. Deming..213 Prospect St., Cadillac, Mich.
8 DLJ Carl A. Pilkington.....Portland, Mich.
8 DOF Lawrence Hennigan.....27 King St., Elred, Pa.
8 DSR John Bruning, Jr., 2344 Clifton Ave., Cincinnati, Ohio
8 LR Roy R. Palmer, 325 N. Penn Ave. (Rear) Lansing, Mich.
8 ON Gordon W. Jewett..510 Clay St., Watertown, N. Y.
8 TX Earl H. Schwenger..1922 E. 93rd St., Cleveland, Ohio
8 UX Donald A. Hoffman, 1551 Suite 8, E. 93rd St., Cleveland, Ohio
8 AZC Levon McDonald..214 Lansing St., Owosso, Mich.
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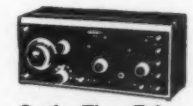

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